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ABSTRACT

This synthesis report provides an extensive overview of literature evaluating use and effectiveness of distance learning technologies in delivering continuing education (CE) for health professionals. Chapter 2 discusses advantages and disadvantages of correspondence materials, explores suggestions for improving print-based learning materials, and identifies resources for information regarding effective design of print-based CE programs. Chapter 3, on audio-mediated technologies, focuses on these three: audio teleconferencing, radio, and audiocassettes. Each is reviewed, advantages and disadvantages are explored, and examples of its application in delivery of CE are provided. Chapter 4 examines video-mediated technologies, their advantages and disadvantages and their use in CE. They include videoconferencing, broadcast and closed-circuit television networks, slow scan video, and video-based satellite broadcasting. Chapter 5 describes computer-mediated learning (CML) technologies: CD-ROM, interactive videodisc systems, and Internet and World Wide Web. Many advantages are addressed: storage capacity, rapid access to information, place and time independence, interactive learning, individualized instruction, self-paced learning, learner control, just-in-time learning, cost savings. Disadvantages are considered: costs, technical limitations, security, and access. CML planning and managing are then discussed. (Appendixes include a summary of experimental research reviewed, abstracts and study summaries, and 491 references.) (YLB)

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University of Newfoundland

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Centre for Collaborative Health Professional Education,
Faculty of Medicine
Memorial University of Newfoundland © 1999

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A Synthesis Report of the Literature Investigating Continuing Professional Health Education at a Distance

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University of Newfoundland

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Executive Summary

In Canada, an unbalanced distribution of health care providers between urban and rural communities contributes to the challenge of providing sustainable rural health care services and programs. As an example, although 23.5 percent of Canadians live in rural areas, including communities with populations of up to 10,000, only 17 percent of family physicians and 4 percent of specialists practice in these areas (Rourke, 1993). This apparent "under-servicing" has prompted many initiatives to improve the education, recruitment, and retention of rural health care providers and has become a priority of rural communities, schools of health professional education, health professional associations, and governments.

There are many obstacles with regard to recruiting and sustaining an adequate supply of rural health care practitioners. Common deterrents include lack of time for family and leisure, lack of work and educational opportunities for family members, professional isolation, lack of professional development opportunities, low salaries, poor locum support, underfunded hospital services and over-scheduling (Rourke, 1993; Rourke, 1994). Each rural setting has its own special challenges. In the smallest, most remote communities, help is a long time and distance away. This places immense strain on limited local resources and on the rural health care provider, particularly when emergencies occur. In larger rural communities with a small hospital there are different stresses. The rural doctor usually has a practice that includes house calls, nursing home visits and even extensive hospital-based medicine in addition to regular office practices. This means extra work including emergency medicine shifts, direct care of in-hospital patients, obstetric deliveries and sometimes general practice anesthesia.

Rural physicians, nurses, and pharmacists consistently identify the accessibility of continuing education (CE) as pertinent to their choice of practice location. In rural areas, physicians' often report that the potential barriers to accessing continuing medical education (CME) include ongoing practice responsibilities, travel distance, and cost. According to McDowell, Challis, Lockyer, White, Adams & Parboosingh (1987) because of the rural physician's isolation continuing education activities are often restricted to individualized reading, completion of self-assessment programs, and participation in the very occasional workshop which involves a guest speaker who visits the community. When rural practitioners seek out and make attempts to attend conferences in major urban centres, the logistics of arranging practice or hospital coverage, accommodations, and transportation makes participation very difficult.

Nurses in rural communities also encounter several barriers to participation in professional development and continuing education programs. Some of these barriers include being far removed from library resources and the long travel distances to meetings of their professional associations. According to Treloar (1985) for many nurses it is very difficult and costly to travel to high quality continuing education programs. This is particularly true in areas where travel may be seasonally restricted due to climatic conditions or where educational resources are sparse or poorly distributed. Rural nurses find it difficult to travel to distant sites to attend continuing education offerings because staffing and financial constraints often restrict the number of nurses that health care agencies can send to outside courses (Clark & Cleveland, 1984). Providers, as well, often find themselves limited as to the number of workshops that can be presented in multiple locations throughout a large geographic area.

Pharmacists practising in rural areas also find that access to continuing education opportunities are few and far between. According to Fielding & Dinning (1981) there are a large number of pharmacists who practice in smaller urban centres and rural areas of Canada whose professional development needs are simply not being met. DeMuth (1996) reported that the major barriers for pharmacists' participation in continuing education were related to time constraints, job constraints (such as lack of relief staff), the scheduling and location of group learning, and family commitments. One of the greatest barriers for rural pharmacists was the centralized location of most face-to-face continuing education programs. This was a major problem for practising pharmacists because it required them to travel long distances from their community in order to participate.

In order to provide high-quality health care services, health professionals require effective ongoing professional development and continuing education programs. With the rapid advances which are occurring in the health sciences, it is becoming increasingly challenging for health care professionals to stay abreast of the latest health research information (Whitten, Ford, Davis, Speicher, & Collins, 1998). Knowledge in the health sciences is constantly expanding as new information is published, disseminated, and quickly updated or revised. In this context, the health care practitioner is placed in the unenviable position of having to provide the best health care to the public while trying to use and apply a rapidly changing body of knowledge (Lorenzi, Kues, & Anthony, 1984). For the rural health care provider, gaining access to this timely information is an even greater challenge because of her isolation and distance from the larger tertiary care and teaching hospitals where this information exists.

The dilemma then is to determine the best means for providing continuing education to the rural and remote health professional. Traditional methods of providing instruction and educational support to groups gathered in one central place are no longer meeting the needs of an increasing number of health professionals (Twigg & Brennan, 1990). A review of the literature concerning the use of communications and information technologies to deliver continuing education programs to rural and remote health care professionals suggests that these modalities have become increasingly popular over the years (Hoeksel, 1994). Useful approaches to addressing continuing medical education needs, including regional CME workshops and the use of distance education technologies have proven applicable for delivering CME in rural and remote practice areas (Rourke, 1988; Gill and Game, 1994; Rosenthal & Miller, 1982; Strasser, 1992; Wilson, Wellman, Fenton & Witzke, 1982; Wise, 1994). Several studies have focused attention on the use of modern telecommunications and computer technology for delivering CE to the rural and remote health care provider population. Of these technologies, several have been well documented in the literature. Audio teleconferencing, video teleconferencing, slow scan imaging, and videotape programs have all been used for many years to deliver CE at a distance. (Black & Dunikowski, 1985; Dunn, Acton, Conrath, Higgins & Bain, 1980; Lindsay, Davis, Fallis, Willison & Biggar, 1987; McDowell, Challis, Lockyer, White, Adams & Parboosingh, 1987; Oeffinger, Hiebeler, Sherman, Gaskill, Portante, Polasek & Litterer, 1992; Moore and Hartman, 1992).

Nevertheless, instructional technologies are only tools by which learning is facilitated and instructional material delivered. Telecommunication and computer technologies can solve many of the efficiency and access problems encountered by rural and remote health care practitioners, but issues surrounding the instructional effectiveness of continuing education programs at a distance are often neglected in reports of technological use. Collis (1993) believes that considerable experience has already been accumulated with respect to the use of telecommunications in distance education, however the rapidly advancing possibilities of the distance learning technologies are challenging those involved in the design, implementation, and evaluation of electronically distributed learning. One of the main challenges, now and in the future, includes the issue of how to predict and evaluate the educational impact and added value of new possibilities in telecommunications while they are still in evolution. In this regard, evaluation studies are particularly important.

The purpose of this synthesis report is to provide an extensive overview of the English-language literature which has evaluated and reported the use and effectiveness of distance learning technologies in the delivery of continuing professional health education. Several objectives guided the collection, examination, and synthesis of the literature which was included in the report: (i) to summarize the scope of research studies and literature identified and examined, including the summarization of research designs and key outcome findings; (ii) to summarize the major findings resulting from the review of the literature, particularly educational effectiveness, cost-benefit analysis findings, technological infrastructure, and problems encountered; (iii) to draw conclusions and identify possible policy implications, uncover gaps in the literature, and provide recommendations for further areas of investigation.

The first step in the preparation of the synthesis report involved the identification of the relevant literature to be included and reviewed. Articles that reported empirical results, both quantitative and qualitative, were the primary focus of the search and the synthesis. The computer databases which were used to identify appropriate articles included the Research and Development Resource Base (RDRB) in CME (University of Toronto), ERIC, MEDLINE, CINAHL, IPA, and HealthSTAR. The literature search also involved the use and cross-referencing of six categories of key search terms. These categories were labeled as distance education, continuing education, audio, video, print, and computer. All of the key search terms were used and cross-referenced during the literature search on each of the five databases.

A synthesis report of this type is timely, given the rapid advancements and developments experienced in the communications and information technology fields in recent years. The literature reports that a number of different technologies have been used to provide rural and remote practitioners with opportunities for continuing their education and professional development at a distance. Much has been learned from the attempts to effectively utilize these technologies in delivering instructional programming to nurses, physicians, and pharmacists in rural communities. This synthesis report attempts to collect and summarize these reports, their main findings, and the strengths and weaknesses of the technologies which have been reported by innovators in the field.

Evaluation studies such as those which have been reported in the literature, as well as synthesis studies, are needed and vital if these new instructional technologies are to be successfully developed and effectively used in the continuing education of rural and remote health care providers. Rural communities need guidance before they invest scarce resources in expensive technologies that may not be appropriate or adequate for their needs. Governments, health care boards, and continuing education providers need additional information to ensure that new rural telemedicine and distance education projects are appropriate and effective. As well, reliable information about how well different technologies work for different purposes, the effectiveness of these technologies in achieving identified outcome measures, and the lessons that have been learned by the pioneers in the field, could help others avoid the same mistakes and improve on the efforts of their peers.

1.0 Introduction

There are many obstacles with regard to recruiting and sustaining an adequate supply of rural health care practitioners. Common deterrents are usually related to a lack of time for family and leisure, lack of work and educational opportunities for family members, professional isolation, lack of professional development opportunities, low salaries, poor locum support, underfunded hospital services, and over-scheduling (Rourke, 1993; Rourke, 1994). Each rural setting has its own special challenges. In the smallest, most remote communities, help is a long time and distance away. This places immense strain on limited local resources and on the health care provider, particularly when emergencies occur. In larger rural communities with a small hospital there are different stressors. The rural doctor usually has a practice that includes house calls, nursing home visits, and even extensive hospital-based medicine in addition to regular office practices. This means extra work involving emergency medicine shifts, the direct care of in-hospital patients, obstetric deliveries, and sometimes the delivery of general practice anesthesia services.

Rural physicians, nurses, and pharmacists consistently identify the accessibility of continuing education (CE) as pertinent to their choice of practice location. In rural areas, physicians' often report that the potential barriers to accessing continuing medical education (CME) include ongoing practice responsibilities, travel distance, and cost. According to McDowell, Challis, Lockyer, White, Adams & Parboosingh (1987) because of the rural physician's isolation continuing education activities are often restricted to individualized reading, completion of self-assessment programs, and participation in the very occasional workshop which involves a guest speaker who visits the community. When rural practitioners seek out and make attempts to attend conferences in major urban centres, the logistics of arranging practice or hospital coverage, accommodations, and transportation makes participation very difficult.

Rural health care delivery is a demanding and challenging form of practice regardless of the profession. As an example, the rural physician or nurse practitioner frequently practices in an isolated environment with inadequate resources and limited or distant specialist back-up resources. This isolation necessitates a level of clinical competence beyond that of their urban health care peers. The rural physician, in particular, is often expected to perform a generalist role in every aspect of clinical practice. Because of this, she must develop and maintain a special base of knowledge and technical skill in a variety of clinical areas, particularly in those related to rural medicine -- emergency medicine, obstetrics and anesthesia (Rourke, 1988; Woolf, 1991; Kamien & Buttfield, 1990; Gill & Game, 1994).

Several studies have confirmed the existence of these unique and varied continuing medical education needs among rural physicians (Rourke, 1988; Woolf, 1991; Kamien & Buttfield, 1990; Gill & Game, 1994). Some studies have also investigated the differences between the rural and urban physician's continuing education needs (Lott, 1995; Rosenthal & Miller, 1982; Woolf, 1991). These studies indicate significant differences in the continuing medical education needs of rural and urban medical practitioners. A large number of these studies also suggest that these differences are influenced by the nature of medical practice and, in some instances, by the distance of a rural medical practice from major urban areas. The further a rural physician is from an urban area and large urban health care resources, the more knowledgeable and competent he must be in a greater number of clinical areas.

It is no coincidence that rural health care providers experience great difficulty participating in, and accessing, continuing professional education. The very factors which characterize rural health care delivery also present significant barriers for participating in CE activities. Geographic distance contributes to the cost of attending selected CE activities and increases the time required to be away from family and work. Arranging the necessary locum or replacement coverage for their pharmacy, practice, and/or hospital responsibilities also makes "getting away" difficult for pharmacists and rural physicians. These obstacles are of great concern for the rural health care provider who must maintain his skills in an ever-changing and developing field of health care practice.

In order to provide high-quality health care services, health professionals require effective ongoing professional development and continuing education programs. With the rapid advances which are occurring in the health sciences, it is becoming increasingly challenging for health care professionals to stay abreast of the latest health research information (Whitten, Ford, Davis, Speicher, & Collins, 1998). Knowledge in the health sciences is constantly expanding as new information is published, disseminated, and quickly updated or revised. In this context, the health care practitioner is placed in the unenviable position of having to provide the best health care to the public while trying to use and apply a rapidly changing body of knowledge (Lorenzi, Kues, & Anthony, 1984). For the rural health care provider, gaining access to this timely information is an even greater challenge because of her isolation and distance from the larger tertiary care and teaching hospitals where this information exists.

One of the distinguishing characteristics of a profession is the commitment by its members to the promotion of continued study and lifelong learning (Buchholz, 1979). This commitment is vital to the health professional because with the constant acceleration of change in health sciences information, no amount of formal education, no matter how complete or excellent, can totally prepare him for a lifetime of learning

(Herman & Buerki, 1977). As a result, health care professionals employ many methods in an attempt to stay abreast of this new information and to meet their continuing education needs. Formal and informal activities can include attending rounds, reading books and journals, discussing papers with peers, attending conferences, workshops, and lectures, and using video and audio tape devices (Young, 1995; Kaufman & Brock, 1998). However, a critical issue and challenge for the health care professional in rural areas is the difficulty they encounter in receiving and participating in continuing education (Byers, Hilgenberg, & Rhodes, 1996; Latchem & Rapley, 1992).

Nurses in rural communities encounter several barriers to participation in professional development and continuing education programs. Some of these barriers include being far removed from library resources and the long travel distances to meetings of their professional associations. According to Treloar (1985) for many nurses it is very difficult and costly to travel to high quality continuing education programs. This is particularly true in areas where travel may be seasonally restricted due to climatic conditions or where educational resources are sparse or poorly distributed. Rural nurses often find it difficult to travel to distant sites to attend continuing education offerings because staffing and financial constraints often restrict the number of nurses that health care agencies can send to outside courses (Clark & Cleveland, 1984). Providers, as well, often find themselves limited as to the number of workshops that can be presented in multiple locations throughout a large geographic area.

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1.1 Distance Education

Distance education occurs when an instructor and learner(s) are separated by geography and time, and instruction is mediated through either print, communication technology, computer-based technologies, or a combination of these technologies. Several authors have highlighted subtle differences in their definition and discussion of distance education. For example, Moore (1973) emphasized the importance of communication between teacher and learner in his definition, but also suggested that there were instructional methods that were appropriate to distance education:

> "As those teaching methods in which, because of the physical separation of learners and teachers, the interactive as well as the practice phase of teaching is conducted through print, mechanical or electronic devices." (p.69)

Peter (1973) described distance education as a new form of technocratic education where the interpersonal face-to-face communication commonly found in traditional education was replaced by an impersonal, electronic communication created by industrialization:

> "A method of imparting knowledge, skills, and attitudes which is rationalized by the application of a division of labour and organizational principles, as well as by the extensive use of technical media, especially for the purpose of reproducing high quality teaching material which makes it possible to instruct greater numbers of

students at the same time wherever they live. It is an industrialized form of teaching and learning." (p.206)

Keegan (1990) conceptualized distance education as a form of education characterized by the following:

> "1. The quasi-permanent separation of teacher and learner throughout the length of the learning process (this distinguishes it from conventional face-to face education);
>
> 2. The influence of an educational organization both in the planning and separation of learning materials and in the provision of student support services (this distinguishes it from private study and teach-yourself programs);
>
> 3. The use of technical media -- print, audio, video, or computer -- to unite teacher and learner and to carry the content of the course;
>
> 4. The provision of two-way communication so that the student may benefit from or even initiate dialogue (this distinguishes it from other uses of technology in education) and;
>
> 5. The quasi-permanent absence of the learning group throughout the length of the learning process so that people are usually taught as individuals and not in groups, with the possibility for both didactic and socialization purposes." (p.44)

Distance education delivery modes are distinguished according to the technologies and medium used to carry the learning materials and/or facilitate the two-way communication between participants and instructors. The four main categories of distance learning technologies are audio, video, computer (data), and print. Dating back to the late 1800s and early 1900s, correspondence study appears as the first format which was used for providing educational programming to adult learners residing and studying at a distance from an educational institution or an instructor. According to Dillon (1996) correspondence study evolved from the early extension education movement and its purpose was to extend educational opportunities to all people. In its earliest days it was sometimes known as education by mail because messages were communicated by print and distributed through the mail system.

Beginning in the 1920s, the means of communication slowly shifted from the medium of print to the mass media of radio. Early initiatives with radio saw the delivery of distance education programming to farmers in rural areas of the US and Canada. The 1940s and 50s saw another shift in distance education to educational television, and the resulting "one-to-many" patterns of communication offered by the broadcast technologies. Television brought with it a higher level of bandwidth for expanding the range of continuous frequencies offered by a transmission. Low bandwidth technologies such as print and radio relied primarily upon symbols and words for communication, while high bandwidth technologies such as television, relied on the transmission of images for communication. The new generation of video-based delivery modalities meant that the concreteness of pictures, motion, and sound could replace the abstract nature of words which were inherent to the print-based media.

The next technological breakthrough was around 1970 with the advent of two-way audio systems. Interaction between instructor and the adult learner was now possible, but many found it was difficult to maintain the learners' attention without anything to visualize. Then, satellite courses, implemented in educational settings during the mid 1970s, using one-way video and two-way audio, allowed for interaction at a verbal level and to some extent at the visual level. In the mid 1980s, the advent of two-way audio and video systems, also known as two-way interactive video systems, revolutionized distance learning and allowed instructors and learners at distant sites to communicate with one another at both a visual and verbal level.

In the 1990s, the landscape of the distance education field has been transformed yet again. Significant advances in information and communication technology have enabled the rapid movement of information to almost anywhere in the world. Computer capacities and speeds have advanced to levels previously unimaginable, and present day innovations in multimedia and data compression capabilities are enabling the integration of voice, data, and images over computer networks. Delivery systems that use fiber optics or regular telephone lines are also making use of advanced telecommunication technologies (e.g., Integrated Services Digital Network) and these are revolutionizing the technologies used for delivering distance education programming.

These new developments in computer technologies have enabled the growth of a new generation of technologies for facilitating distance learning. Unlike correspondence study, computer mediated communications offers a very immediate and interactive form of communication. Communication which occurs via computers and computer networks travels at the speed of light, rather than at the speed of the postal service. Computer mediated communications also offers both synchronous (real time) and asynchronous delayed interaction (time and place independence) and can provide the benefit of both group-paced and individualized learning.

The increased capacities of these information and communication technologies have also contributed to a movement away from traditional CE (Moore et al., 1994). Physicians, nurses, pharmacists and other health care providers who have installed computers in their offices can access a variety of distant databases. In some areas, electronic consultation networks have developed using e-mail technology and medical information systems which provide the rural physician with rapid access to assisted literature searches and other information sources. As well, direct telephone or even video consultations are rapidly evolving and shrinking the rural professional isolation problem (Kantrowitz et al., 1979; Verby & Feldman, 1983; Money, 1986; Moore & Hartman, 1992; Puskin, 1992). Telemedicine, using a combination of computer, multimedia and telecommunications technology is expanding throughout the world. According to Moore and colleagues (1994):

> "We believe that the forces that are currently changing health care........will shortly provide opportunities to create a new CME, one that will be more accessible, more convenient, and more relevant. This will be the new paradigm for CME." (Moore et al., 1994, p.11)

Collis (1993) believes that considerable experience has already been accumulated with respect to the use of telecommunications in distance education, however the rapidly advancing possibilities of the distance education technologies are challenging those involved in the design, implementation, and evaluation of electronically distributed learning. One of the main challenges, now and in the future, includes the issue of how to predict and evaluate the educational impact and added value of new possibilities in telecommunications while they are still in evolution. In this regard, evaluation studies are particularly important.

In Canada, the trend appears to be towards greater usage of communication and information technologies in the health care system and in the continuing education of health professionals. Canada, which is geographically the largest country in the Western Hemisphere and the second largest in the world, faces unique difficulties in delivering health care. Eighty-nine percent of the country contains no permanent settlement, and outside the urban-rural blocks where most of the population is settled, there are numerous unconnected settlements. An unbalanced distribution of physicians between these urban and rural communities also contributes to the challenge of providing health care in this country. Although 23.5 percent of Canadians live in rural areas, including communities with populations of up to 10,000, only 17 percent of family physicians and 4 percent of specialists practice in these areas (Rourke, 1993). This apparent "under-servicing" has prompted many initiatives to improve the education, recruitment, and retention of rural physicians and has become a priority of rural communities, medical schools, medical associations and governments. In one way, improved access to effective and quality distance learning opportunities offers a true means for addressing recruitment and retention challenges, maintaining and improving the competency of rural health care providers, and enhancing the quality of care provided to rural and remote communities.

1.2 Report Purpose

The purpose of this synthesis report was to provide an extensive overview of the English-language literature which has evaluated and reported on the use and effectiveness of distance learning technologies in the delivery of continuing professional health education. The main emphasis of the report is the examination, identification, and synthesis of past and current research findings pertaining to the planning of telehealth learning networks and the design, development, delivery, and evaluation of continuing professional health education programs at a distance. The synthesized findings of this report have particular relevance for the effective and efficient development, transfer, and implementation of distance education methods and telehealth learning networks in providing continuing professional health education to rural and remote health care practitioners.

1.3 Report Objectives

The main objectives of the synthesis report include:

1. To summarize the scope of the research studies and literature identified and examined, including the summarization of research designs and results according to the following criteria:

Study Criteria
technology used (type and telecommunication infrastructure)
type of study (case report, evaluation research study, commentary, practice issues)
study focus (goals and research questions)
study participants
research methodology (pre-experimental, quasi-experimental, experimental)
for evaluation research studies, the type of evaluative categories assessed (learning achievement, participant satisfaction, performance change, impact on patient health outcomes)
sample size (response rates where survey research was reported)

2. To summarize the major findings resulting from the review of the literature, particularly educational effectiveness, cost-benefit analysis findings, technological infrastructure and problems encountered.

Major Findings
major findings (educational effectiveness)
identification of common themes among studies instructional design processes followed key instructional strategies
cost-benefit analysis -- establishment and utilization of telelearning networks, distance education methods and modalities
reported faculty effort assessments (distance delivery vs. face-to-face)
faculty satisfaction with delivery modalities
reports of technology usage (problems encountered and learned experiences)
limitations of findings

3. To draw conclusions and policy implications, identify gaps in the literature and provide recommendations for further areas of investigation.

1.4 Report Methodology

The first step in the preparation of the synthesis report involved the identification of the relevant literature to be included and reviewed. Articles that reported empirical results, both quantitative and qualitative, were the primary focus of the search and the synthesis. Studies which also documented key strategies for structuring instructional delivery were included as well. Seminal review articles and other meta-analysis studies were included where available and applicable to the synthesis focus. Research articles that did not use a sample of professional health care practitioners nor report on educational initiatives directly involving continuing professional health education were only included if they reported on a phenomena of importance to the subject of inquiry. Studies investigating continuing professional education at a distance in general, fell into this category.

The computer databases which were used to identify appropriate articles included the Research and Development Resource Base (RDRB) in CME (University of Toronto), ERIC, MEDLINE, CINAHL, IPA, and HealthSTAR:

MEDLINE Advanced - A literature database sponsored by the national Library of Medicine. This database was searched from 1985 to March/April 1999 inclusive;

CINAHL - The database version of the Cumulative Index to Nursing and Allied Health Literature which is sponsored by CINAHL information systems. This database was searched from 1982 to March/April 1999 inclusive.

IPA - International Pharmaceutical Abstracts sponsored by the American Society of Health System Pharmacists (ASHP). This database was searched from 1970 to March/April1999 inclusive.

HealthSTAR - A literature base sponsored by the National Library of Medicine and the American Hospital Association. This database was searched from 1990 to March/April 1997 inclusive.

ERIC - Educational Resources Information Center sponsored by the US Department of Education. This database was searched from 1966 to March/April 1999 inclusive.

The literature search also involved the use and cross-referencing of six categories of key search terms. These categories were labeled as distance education, continuing education, audio, video, print, and computer. All of the key search terms were used and cross-referenced during the literature search on each of the five databases. The six categories of search terms which were used included:

Key Search Terms

Distance Education distance education distance learning distributed learning open learning extension education	Continuing Education continuing medical education continuing nursing education continuing pharmacy education continuing professional health education continuing professional education extension education continuing education
Audio audio teleconferencing audiographic teleconferencing audio tapes audio cassettes electronic blackboard electronic whiteboard teleconferencing two-way radio radio telewriter telephone instruction telephone conference	Video video conferencing video teleconferencing interactive television educational television television video video tapes slow scan image(s) slow scan imagery
Print print-based print correspondence home study	Computer computer assisted instruction computer aided instruction computer managed learning computer based training computer based learning computer mediated learning computer mediated instruction World Wide Web computer conferencing computer mediated communications Internet CD-ROM new media learning instructional courseware instructional software interactive multimedia

In summary, this report synthesizes the findings of those studies which have evaluated or reported on the use and effectiveness of distance learning technologies in providing continuing professional health education to three distinct groups of health care providers: nurses[1], pharmacists, and physicians. The literature which is reported in this report is international in scope, reflecting the study of distance education in health professional education and the evaluation of distance learning projects from Canada, the United States, United Kingdom, Europe, and Australia. The main limitation of the report is that only the English language literature was reviewed. Therefore, it is very likely that exciting and informative projects which have occurred, but not reported in the English language literature are not reviewed in this synthesis report. However, despite these limitations the synthesis report does document the most significant studies and literature related to the use of distance learning technologies in delivering continuing professional health education. The information which is summarized and outlined in this report should be of assistance to a large number of individuals who have a stake in the quality and effectiveness of continuing education opportunities which are provided to rural, remote and urban health care professionals.

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[1] **CE in Nursing**

In the field of nursing, three categories of traditional continuing education have been identified: formal academic study leading to a degree, short-term courses or programs offered by institutions of higher learning, but not necessarily directed toward a degree, and independent and informal study carried on by the practitioner herself, utilizing learning opportunities which are available to her through her profession or employing agency. It is up to the individual nurse to decide, on the basis of his present competencies, career goals and life circumstances, which kind of continuing education is most appropriate for him.

2.0 Print and Correspondence Study

2.1 Introduction

Decreasing budgets and increasing responsibilities have forced many rural health care professionals to search for alternative forms of continuing education. In many cases, rural practitioners often work in understaffed clinics or hospitals where there is neither the money nor the relief staff available so one can attend a continuing education program. Rao (1997) notes that many physicians are being forced to follow the "learning while earning" principle and therefore require more convenient and accessible forms of continuing medical education. Various academic and medical institutions have attempted to address this issue by introducing print-based or correspondence-type continuing education programs which can be completed at a distance.

According to Willis (1995) print-based distance education has been a mainstay of distance education and distance learning materials, and is the basis from which all other delivery systems have evolved. Many of the first distance education courses were offered by correspondence study, with print materials and correspondence sent and returned to students by mail. Even with the arrival of newer advanced distance learning technologies, print-based materials have remained an integral component of most distance education programs. Correspondence materials do not rely on any advanced educational technologies for delivery, and are therefore easy to use and edit. As well, the production costs for print materials are reasonable and the delivery mechanisms for correspondence courses are not dependant on the technological infrastructure or savvy of an institution.

A main concern regarding the implementation of any distance learning program is the effectiveness of the method of delivery. Print-based programs, like all instructional modalities, have both advantages and disadvantages. Fiene, Fannon, Drewry & Spahn (1984) proposed that when self-instructional materials were written by experienced educators who were knowledgeable of their topic and developed within a versatile process, using a proven format, they were extremely valuable teaching aids. In the following sections the advantages and disadvantages of correspondence materials are discussed, suggestions for improving print-based learning materials are explored, and possible resources for information regarding the effective design of print-based continuing education programs are identified.

2.2 Advantages

The most obvious advantage of print material is its ability to provide instruction to health care professionals who are located in geographically remote areas. The development of print-based continuing education programs means that professionals can access convenient and flexible educational programs (Matchett, 1978; DeMuth & Weinswig, 1984; Docking, 1993) regardless of where they live or practice. According to Treloar (1998) correspondence courses provide the opportunity for learning which is self-directed, can occur at the learner's own pace, and is flexible to the demands of the practitioner's work and family commitments. Packaged, print-based continuing education programs can also be conveniently started and stopped at any time by the adult learner (Matchett, 1978). In this manner, they represent an asynchronous form of instruction. In a survey to determine the opinions of pharmacists to mandatory continuing education in Alberta, Friesen, Zinyk & Mah (1995) found that the convenience of obtaining continuing education units via print correspondence was one of the main reasons for its popularity and usage by pharmacists.

According to Matchett (1978) there are several instructional design and production advantages to the use of print-based distance learning materials. The main advantage centers on the principle of "consistency in presentation" which can be maintained and the ease of reproducing the learning materials. Wilson, Wellman, Fenton & Witzke (1982) suggest that one of the greatest benefits of a correspondence course is the ability to tailor instruction to the specific concerns of physicians. Self-instructional units can be modified to accommodate any changes among the needs of a learner group and to incorporate any advances in new clinical techniques (Fiene, Fannon, Drewry & Spahn, 1984). One way to identify the need for revisions or modifications in educational materials is through the assessment of learners' satisfaction. Rhodes-Alden & Carrozza (1997) reported that the use of a feedback survey in each module of a correspondence course is a useful way to obtain learner feedback for the purpose of future revisions to print materials.

The practicality of the learning material is also an important factor in the effectiveness of any distance learning program. In a study which evaluated the use of patient-management problems as a learning tool for CME, physicians reported that the cases which were presented were motivating and effective, and that most of the knowledge they gained was transferred to their own practices (Marquis, Chaoulli, Bordage, Chabot & Leclere, 1984). The use of print-based self-instructional units can also enable the better use of time and energy for newly employed hospital staff (Rufo, 1985). In these instances, new staff members are able to start orientation programs as soon as they begin, rather than waiting for the next scheduled face-to-face program.

Cost Effectiveness

An attractive feature of print-based learning programs is the relatively low cost of production and distribution, with most correspondence materials normally distributed via the postal system. The use of print materials does not require the use and/or purchase of costly technologies such as televisions, cameras, recorders, or telecommunications systems. Materials can be used anywhere at anytime and reproduction is often quick, easy, and economical.

The cost benefits of choosing print instruction as a means of continuing professional education has been discussed in the literature (Wilson, Wellman, Fenton & Witzke, 1982; Matchett, 1978). In a paper explaining the provision of continuing education program for clinical staff, Anderson, Dickson and Lee (1997) reported that initial evaluations indicated that a print-based CE program was a cost-effective and efficient means for delivering professional development. The developers of a CE program for Australian pharmacists chose the use of print instruction claiming that it was still the most cost-effective way of providing effective information, regardless of a pharmacist's location (Anon, 1987). Freisen, Zinyk and Mah (1995) also suggested that cost-effectiveness was one of the main reasons for the acceptability of an Albertan project involving a correspondence continuing education program for pharmacists.

Outcomes and Satisfaction

Several studies in the literature have reported increases in participants' knowledge as a result of participation in print-based instructional programs. In one study, pharmacists who participated in a formalized journal-review program were found to be more knowledgeable on information which was covered in journal articles and discussed through correspondence study (DeMuth, Weinswig & Vanfleet, 1983). In nursing education, nurse educators providing a pilot orientation training program to new staff found that a majority of training modules could be effectively taught using self-instruction (Rufo, 1985). Marquis, Chaoulli, Bordage, Chabot & LeClere (1984) found an increase in physicians' knowledge as a result of participation in a correspondence CME course which required the learner to study and review several patient management problem (PMP) activities. In this particular study, an experimental group which received repeated PMP correction materials showed improved performance over a control group that did not receive any instructional materials. The authors also reported a knowledge transfer of 75 % to the clinical practices of physicians.

Young, Chart, Franssen, Tippings, Morris & Davis (1988) reported a study which provided a home study distance learning program for the continuing education of physicians on breast disease and early detection of breast cancer. In this investigation, an educational package was delivered in two formats: home study and a face-to-face workshop. Two questionnaires were used, one to assess knowledge, and one to measure the attitudes of physicians. For both formats, participants' knowledge and comfort in dealing with breast problems were measured before and after participation in the instructional programs. The results of the study indicated that there was a significant increase in both the knowledge and attitude levels of both the home study and workshop learning groups. As well, the authors found no significant differences between the groups on knowledge gain or attitude toward breast disease.

Evans, Haynes, Birkett, Gilbert, Taylor, Sackett, Johnston & Hewson (1986) also used print-based distance education materials to instruct rural primary care physicians on hypertension management. These authors attempted to examine the educational impact of correspondence study by assessing the degree to which patient blood pressure levels were affected by physicians' participation in the CME activity. The results of the study were not positive, suggesting that the home study instruction did not influence clinical practices. However, as Cervero (1988) proposes, using patient outcomes as indicators of the impact of CME are, at best, challenging and questionable. Even though physicians may have actually learned and applied new knowledge and skill in their practice, they have little control over the compliance of particular patients to treatment regimens. Therefore, while the physicians may have prescribed the correct treatment or management protocols, it is the patient who ultimately controls individual behavior and whether they will comply with the treatment and management plan.

In a similar study, Engel, Browne, Nyarango, Akors, Khwaja, Karim & Towle (1992) of the Wellcome Tropical Institute evaluated a correspondence CME problem-based program for rural family physicians. The findings of this study suggested that problem-based learning activities produced significant increases in rural physicians' knowledge and understanding. The instructional model followed in this study provides a useful outline for the development and delivery of problem-based CME correspondence courses. However, Engel et al.'s report of significant gains in knowledge and understanding were based on subjective observations that the authors had made. The researchers did not use any achievement tests to assess knowledge gain in order to evaluate the instructional effectiveness of their program.

Several studies have also attempted to measure specific changes in clinical behaviors as a result of the provision of correspondence or print-based educational materials. Actual and perceived behavioral changes have been assessed and reported in the literature. Hoskins, Neville, Smith and Clark (1997) reported that UK physicians participating in a distance learning program on the management of asthma showed changes in the management of acute asthma attacks among their patient population. The authors noted however, that the evaluative information was collected using a clinical audit, and those willing to change clinical management behaviors may have also been more willing to participate in an audit.

Correspondence study has also been used in the delivery of continuing pharmacy education at a distance. In one study, ninety two percent of pharmacists who had completed a printed task-based continuing education course reported that self-directed learning tasks were an effective means for initiating change and improving their practices (Cook, 1993). In a similar study, seventy-four percent of pharmacists who had completed a home-study workshop reported that they believed themselves to be more competent in the subject matter which was learned through the program (Tann, Hodges & Stewart, 1992). Wilson, Wellman, Fenton and Witzke (1982) also reported that 70% of physicians who had completed a correspondence course on the pre-term newborn indicated that the information gained from the course would alter how they counseled patients.

Several studies have indicated that participants in print-based distance learning programs respond very positively and favorably to the use of the correspondence study format, and are generally satisfied with the learning experience (Rhodes-Alden & Carrozza, 1997; Wilson, Wellman, Fenton & Witzke, 1982; DeMuth, Weinswig & Vanfleet, 1983; DeMuth & Weinswig, 1984; Martin, 1994; Cook, 1993; Burley & Teasdale, 1991; Tann, Hodges & Stewart, 1992; Abbey, 1987; Cochrane, 1997). Conversely, the findings from other studies reported in the literature suggest that most participants find print-based distance CME boring, report it offers little opportunity for interaction with other learners or the instructor, and requires a great deal of commitment, time and motivation (O'Dochartaigh, 1971; Engel et al., 1992; Boswell et al., 1994). As well, these same studies suggest that there are high attrition or non-complete rates associated with CME courses which are delivered entirely through home-study and correspondence formats.

2.3 Disadvantages

A main limitation of print-based correspondence study is the lack of support which is often not provided to adult learners by course instructors or CE providers. Matchett (1978) reports that a disadvantage of this type of instruction is the absence of an instructor for providing direct feedback and immediate answers to questions from learners. Students in a post-graduate correspondence clinical epidemiology course voiced concerns about the lack of face-to-face contact with university tutors (Treloar, 1998). In another study, several nurses enrolled in a distance learning nursing refresher course indicated that they felt isolated outside the classroom setting and would have preferred group interaction (Rhodes-Alden & Carrozza, 1997).

The flexibility of correspondence instruction can also be both an advantage and a disadvantage. The lack of structure which is provided through a print-based learning program (i.e., the option to study wherever and whenever one wishes) is often perceived as a benefit by some learners and a challenge for many others. Unstructured courses require a great deal of self-discipline (Matchett, 1978) and motivation, and those lacking this disposition generally report difficulty in completing correspondence courses on time.

The majority of correspondence-based materials are usually distributed through the mail system. This method of delivery can be problematic (Matchett, 1978) such as material being misplaced, lost, and even delayed in reaching a learner or instructor. Another concern regarding the use of print correspondence is the relevance of the material to the actual clinical situation. Beaton (1977) claims that self-study books and journals are common methods of CE, but they are often irrelevant to a practitioner's immediate practice and consequently the reinforcement which could be afforded by application does not take place. Price (1989) reported that, in many cases, individual correspondence study exercises or items are not easily adapted to local clinical circumstances and are therefore not incorporated into learning programs.

The assessment of skill enhancement in a home-study format is also a concern (Boswell, Lorenz, Pichert, Schlundt & Penha, 1994). Tann, Hodges and Stewart (1992) reported that the instruction and acquisition of professional skills through a print-based distance learning format was problematic. As an example, Pill and Stott (1988) stated that only 17% of GPs participating in a self-study program on coronary heart disease said they would "definitely" introduce the information into their own practices. In a distance learning program on geriatric nursing, nurses reported that they were concerned about their self-confidence in their clinical competencies after completing a correspondence course (Abbey, 1987). Tann, Hodges and Stewart (1992) also found that hands-on-experience through a face-to-face workshop enhanced behavioral competencies more effectively than a study of print-based distance learning materials alone.

Design issues can also be a problem in some correspondence materials as some programs can be poorly written. Ineffective materials which are unclear and confusing to study often lead to a high level of learner dissatisfaction and unfavorable attitudes by participants. Pharmacists in a home-study correspondence course claimed that the two distinct disadvantages of the course materials included verbosity and repetition within the text (Tann, Hodges & Stewart, 1992). Extra production time and effort is inevitable during the design and development of correspondence materials. Particular attention to detail, the structure, and the presentation of information in the print format is required. Rufo (1985) reported that two concerns emerged regarding the development of print-based learning programs. The first focussed on the possible hidden and direct costs involved in production of these learning packages. The second was the required commitment of the entire continuing education department. All members must be willing to put forth extra time and effort in the initial stages of course development.

2.4 Organization and Planning

Several studies have discussed and presented suggestions regarding the effective development and successful application of print-based distance learning programs. The main elements of these studies are outlined here, but the reader is advised to consult the actual articles for a more detailed discussion and description of the procedures or strategies proposed by the authors. In one project, Fiene, Fannon, Drewry and Spahn (1984) focussed their efforts on the development of a practical process for developing self-instructional units (SIU). In this paper, the authors provide several suggested strategies for writing a SIU, such as the importance of having direct, limited subject matter and the importance of providing a self-directed process for learners to practice what they have learned and obtain feedback.

Abbey (1987) provides a summary of several principles which developers need to consider in developing distance education materials for nurses. Conrad and Price (1993) also describe a number of instructional goals which they used in developing an Adult Critical Care Nursing Program. The authors suggest that these instructional design goals could be adapted by others during the development of any continuing distance education course. Robinson (1984) describes an instructional structure that should be found in any effective distance learning program, while Martin (1994) and Ndeki, Towle, Engel and Parry (1995) also provide overviews of several procedures for the effective preparation, dissemination and evaluation of open learning programs.

One interesting model of curriculum development discussed in the literature pertaining to print-based instruction was the SPICES model. Thomson (1994) describes the SPICES model as a variety of design considerations including whether the material and instruction is Student-centered, Problem-based, involves Integrated teaching, is Community-based in its approach, involves Electives, and is Systematic in design. The findings from several other studies and projects concerning program development and evaluation also provide some specific recommendations regarding ways to improve correspondence-based continuing education programs. Cronenwett (1995) called for more sophisticated and systematic evaluation of the various means of disseminating information and educational material to clinicians. Other researchers have also expressed concern over the lack of formal evaluation of educational materials which are received in the mail (Evans et al., 1986; Boswell, Lorenz, Pichert, Schlundt & Penha, 1994).

Certain design issues have been shown to encourage and increase the effectiveness of print-based instruction. In one study, participants in a patient management problem course found that corrective feedback from an instructor enhanced learning (Marquis, 1984). O'Dochartaigh (1971) advocates methods of distance learning which are relevant to the needs of adult learners, encourage self-directed study, and require practitioners to reflect on their work and the educational deficits which might exist. Boswell, Lorenz, Pichert, Schlundt and Penha (1994) emphasized the need for an individualized and tailored form of feedback to enhance the learning process in correspondence study. In one study, Tann, Hodges and Stewart (1992) found that questions which required the professional to apply reflective and critical thought to their learning, resulted in responses which were qualitatively better that answers to questions which did not.

In order to provide a solution to the isolation problem experienced by many distance learners, several authors have suggested the addition and provision of learner support systems to the distance learning format. Rhodes-Alden and Carrozza (1997) explained that support from a local coordinator in the form of phone conversations, assistance with self-study strategies, and recommendations for additional learning resources scored favorably on a correspondence course evaluation questionnaire by adult learners. O'Dochartaigh (1971) suggests the use of local journal clubs for neighboring doctors and nurses as a means of providing support to those who are learning at a distance. Pharmacists participating in a CE course on asthma reported that a face-to-face workshop in addition to print material, increased their motivation to counsel patients (Cook, 1993). Cook (1997) also found, in a later study, that the organization of a face-to-face workshop to supplement a correspondence program resulted in an increase in participants' motivation and the development of a local learner support system.

Many of the studies of correspondence study reported in the literature were limited in scope, the evaluation methods they used, and the findings they reported. A main focus in some of the studies was the impact of the educational program in terms of knowledge, attitudinal and/or performance change. However, while impact studies are important for indicating the amount of learning or behavior change which has occurred, they overlook the importance of the process of learning, the instructional transactions between learner and learning materials, and the characteristics of the learners which may or may not have contributed to the learning or performance change. Several of the evaluation studies collected detailed participant satisfaction data, but most of the evaluation research which was surveyed offered little information or recommendations on ways to improve print-based instructional materials or correspondence study formats based on reliable or valid evaluative information. As well, the evaluation studies did not report any methods for formatively evaluating instructional materials during the design and development stage of instructional design. This is a major limitation of the evaluations which were reported.

3.0 Audio-Mediated Technologies

The audio-mediated technologies that use the spoken word (voice) to transmit information and/or facilitate interactive communication between learners and instructors are of two general types, synchronous and asynchronous. The synchronous, audio-mediated technology types enable real-time and, in some instances, interactive communication between two or more people at multiple sites. Audio teleconferencing and short-wave radio are examples of the synchronous audio-mediated technologies which have been reported in the continuing education literature. The main difference between the two is that audio teleconferencing allows for "many-to-many" communication, while radio only allows for "one-to-many".

Asynchronous audio-mediated technologies transmit verbal information in a form which is not of a real-time nature, implying that the information is usually produced and stored in some format which allows for playback and review. The audiotape or audiocassette is an example of an asynchronous technology which has been used for providing distance learning to health professionals. Audiotapes allow for a form of communication which is of a "one-to-one" nature, that is information transmission directly to a learner at a time and place convenient for them, much like correspondence study.

The following sections of this chapter will discuss the different variations of audio-mediated technologies which have been reported in the literature. This discussion will focus upon three of the more popular audio-based mediums which were presented in the research: audio teleconferencing; radio; and audiocassettes. Each technology will be reviewed, its advantages and disadvantages explored, and examples of its application in the delivery of continuing education to health care professionals at a distance discussed.

3.1 Audio Teleconferencing

In the wake of the rapid growth of health care knowledge, the maintenance of competency has become a very important concern for both practising health care professionals and the many certifying and licensing bodies which govern them (Synder, Thompson, & Luebbert, 1982). In order to address the need for health professionals to maintain and enhance their knowledge of the health sciences, many continuing education providers have used telephone conferencing or audio teleconferencing. According to Synder et al. (1982) the underlying philosophy of the telephone conference is to provide an efficient and economical means of delivering current information on clinical techniques, treatment, and procedures to health professionals. Teleconferencing allows the health professional to stay in his or her own community and to participate in continuing education programs which are facilitated over conventional long-distance telephone lines. This minimizes some of the time and cost involved with their participation. In advance of each program, printed handouts and visual materials may be forwarded to the respective conference sites to augment the presentation.

Togno, Lundin, Buckley, & Hovel (1996) report the findings of a survey of rural Australian health professionals' usage patterns of information technology and telecommunications (IT&T). The results of the survey strongly support the degree of importance which rural health professionals attach to the use of IT&T to reduce their sense of professional isolation and to support their service provision. The survey results indicated that the telephone and fax were the most widely used technologies, with teleconferences most widely used for professional activities. Seventy percent of the respondents considered themselves to be professionally isolated and that increased IT&T access would reduce this isolation. Seventy nine percent indicated that IT&T applications would help them provide better professional service, 75% said IT&T would improve productivity, and 57% said improved access to IT&T would make travel time more efficient. Forty eight percent of the respondents reported that they expected to begin using some new information and communications technology in the near future.

Audio teleconferencing has been the cornerstone of the distance learning field for many years. Much of what is known about the effective use of teleconferencing for group communications has resulted from investigations of the use of audio teleconferencing technology in distance education applications. As a medium for distance learning, audio teleconferencing systems have served quite effectively as a means for facilitating communicative interaction between instructors and learners when they were not able to be together at the same time and in the same place.

The technical components of a typical audio-only conference might include telephone hand sets, speaker phones or microphones, an audio bridge that interconnects phone lines and controls noise, and a speaker device to facilitate multiple interactions (Willis, 1995). Audio teleconferencing has been used as a continuing education delivery mode for health professionals, and in particular rural physicians, since the 1960s (Meyer, 1983). Its use as a distance learning technology has been reported in several continuing medical education studies from the University of Wisconsin-Madison, University of Alberta School of Medicine, Memorial University of Newfoundland's Faculty of Medicine, the Ohio State University Medical School, Albany Medical College, and selected CME projects in Maine and Texas (McDowell, Challis, Lockyer, White, Adams & Parboosingh, 1987; House, Roberts & Canning, 1981; Parker & Baird, 1977; Gellman & Franke, 1996). In one

study, audio teleconferencing was even used internationally, bridging the Emergency Hospital of Yerevan, Armenia and the Boston University School of Medicine to provide formal continuing medical education opportunities to practicing physicians in that European country (Screnci, Hirsch, Levy, Skawinski & DerBoghosian, 1996).

Several of the studies reported in the literature have evaluated the instructional effectiveness of audio teleconferencing for CME through the collection and summarization of participant satisfaction and registration data (Treloar, 1985; Lindsay, Davis, Fallis, Willison & Biggar, 1987; Lockyer, Parboosingh & McDowell, 1987). Other than these few studies, the literature is very limited in terms of any systematic approaches to evaluating the overall instructional effectiveness of audio teleconferencing in delivering CME to physicians. Most of the studies are concerned with asking questions and providing answers on the technology used, and discussing its implications for cost efficiencies. Many of the studies appear to offer little information which could influence meaningful decision-making regarding the effectiveness of the technology for producing learning gain or changing physicians' performance. In fact, in several of the studies which are noted, the researchers have concluded that there is a significant need for more intensive study of the effectiveness of audio teleconferencing which seeks to assess specific behavioral change in clinician performance or patient outcomes as a result of participation in distance CME (Lindsay et al., 1987; Parker & Baird, 1977).

Teleconferencing, or audio teleconferencing, is defined as simultaneous two-way voice communications between three or more people in two or more places using either: a telephone; speaker or hands-free conference device; a speaker device with microphones and telecommunication services (telephone lines); or a combination of the above (Hart, 1989; Kuramoto & Dean, 1997; Picot, 1984; Synder, Thompson & Luebbert, 1982; Hibbard, Marshall & Hayes, 1986; Henry, 1983; Orgren, 1990; Kasworm & Hampton, 1976; Treloar, 1985). At the most basic level, an audio teleconferencing system may incorporate telephones that have amplified speakers and microphones embedded in the base component of a handset. These specialized features enhance the telephone's normal functions and allow a user to participate in an audio teleconference session using basic telephone equipment. This set-up may also allow several other people in the same room to participate in the conversation with another user. This speaker phone equipment extends the person-to-person capabilities of the typical telephone call and makes it possible to have a group-to-group conversation.

At the other end of the spectrum are more sophisticated devices known as audio teleconferencing systems or, as they are sometimes called, group audio teleconferencing terminals. These advanced systems enable the establishment of large-scale audio teleconference networks which use equipment that enhances the functionality of normal telephone equipment. Speakers, microphones, and other connecting devices allow groups of participants at multiple sites to communicate with one another at a distance. The two basic components of these audio teleconference systems include a speaker box that plugs directly into a telephone jack and a set of microphones that are connected to the speaker. These components amplify the sound and enable several participants to partake in a teleconference discussion. An audio teleconferencing network also requires one further device to enable a connection between three or more sites and this equipment is known as a bridge.

Audio bridges, or linking devices, are used to link telephones or teleconferencing sites together so the parties at all locations can hear and talk to each other. There are different types of bridges, a dial-out teleconferencing forum uses a central bridge in which a conference is handled by an operator who calls each location to link it into the conference. A dial-in or "meet me" bridge requires that all parties involved in a conference dial a pre-determined number at a designated time. Each call is answered automatically, or by a bridge operator, and placed into the teleconference forum along with other incoming calls. Access to a telecommunications bridge can be made possible through a local telephone exchange, from a private sector vendor, or sometimes through educational institutions that use teleconferencing to support distance learning programs. One variation of a teleconferencing system which is often used to support distance learning programs is known as a dedicated system. A dedicated system involves the rental of telephone lines and facilities on a 24-hour basis, thereby establishing a no-dial network between all points on the system. Participants do not have to dial-in to a number nor have an operator dial them. Established teleconference sites on the dedicated network are always connected to a conferencing bridge which is usually controlled by a central teleconference manager.

According to Lockyer et al. (1987) the use of audio teleconferencing for continuing education in the health professions was first pioneered in Wisconsin in the mid-1960s and in Newfoundland in the late 1960s. The department of Continuing Medical Education at the University of Wisconsin-Madison initiated the use of teleconferencing for continuing education delivery in November of 1965 (Meyer, 1983). Teleconferencing facilities were installed in 18 hospitals across the state with the furthest sites up to 350 miles from Madison. In the mid-1970s the network had expanded to over 170 different locations throughout the state, and between 1966 and 1976 more than 28,000 nurses in Wisconsin are reported to have participated in continuing education programs over the system (Treloar, 1985; Parker & Baird, 1977).

Today, the Educational Telephone Network (ETN) of the state of Wisconsin is a closed-access telephone network which links university health science

departments and resources in the state's capital of Madison with learners around the state. About 60 of Wisconsin's 140 general hospitals are reported to have enrolled annually in the network. The University of Wisconsin Extension Division and the Departments of Continuing Medical Education, Nursing, and Pharmacy collaborate annually to offer more than 300 hours of educational programs to the state's hospitals. ETN classrooms have a suitcase-size speaker that plugs into a standard telephone jack, an AC power outlet, and four microphones. Local program coordinators are appointed to coordinate, promote, administer and serve as local contacts for all programs at their designated sites. Fees for participating in the network are prorated according to the number of hospital beds of a participating institution.

In Newfoundland and Labrador, a similar teleconferencing network was developed during the late 1960s to provide continuing medical education to the many rural physicians practising medicine in the geographically isolated outports along the province's rugged coastline. The CME department at the Faculty of Medicine organized weekly, one-hour long teleconference sessions called the Wednesday at Noon program (House et al., 1981). The teleconference system operated like a modified party line with groups of physicians in different hospitals using microphone and speaker equipment instead of telephones. In order to supplement the interactive audio system, copies of audiovisual or handout materials were prepared in advance and circulated to all participants in the program. The technical equipment which was used also allowed ordinary dial-in telephone lines to be bridged into the dedicated system which enabled participants from non-dedicated sites to participate as well.

A number of examples of the application of audio teleconferencing in the continuing education of health professionals in Canada are presented in the literature. Given Canada's geography, a vast and sparsely populated area, it is a natural territory for distance learning. The isolation and remoteness of many regions of the country necessitates the need to link people and communities to ensure the effective and efficient exchange of information. In 1982, a joint venture between the Royal College of Physicians and Surgeons of Canada and the Toronto General Hospital saw the development of Telemedicine Canada, a national teleconferencing network which boasted more than 360 participating sites nationwide (see Continuing Education through Telemedicine, 1988). The network offered an extensive array of programming and at one point Telemedicine Canada managed the production of 35 different teleconferencing programs for physicians, nurses, and allied health care professionals.

Teleconferencing was also introduced and used in the provinces of New Brunswick and Alberta, Canada. In 1982, a pilot project involving audio teleconferencing and video transmission (slow scan freeze frame) technologies was implemented through the Dr. Everett Chalmers Hospital in Fredericton and involved 10 sites in the rural catchment area surrounding the capital of New Brunswick (Takacs, 1984). The Office of CME, University of Calgary also established a teleconference network during the 1980s which had grown to include over 37 hospitals for the delivery of province-wide CME programs. According to the results of feedback questionnaires completed after each teleconference session, McDowell et al. (1987) reported that participants were highly satisfied with the programs and many indicated that specific changes in practice procedures had occurred as a result of their participation in the teleconferences.

Audio teleconferencing technology has also been used extensively in the provision of continuing nursing education. Kuramoto & Wyman (1986) reported a study at the University of Washington, School of Nursing which compared the effectiveness of teleconferencing with face-to-face instruction and independent study packages. The findings indicated that the teleconferencing participants were more highly committed to attending class sessions than the face-to-face participants. Further, learning was associated with all three delivery modalities and a 6-month follow-up indicated that the content was relevant and was widely applied in the learners' work settings, despite the mode of delivery. In another study, Hart (1989) found that a large majority of participants in a continuing nursing education program by teleconferencing were very satisfied with the learning experience. In this particular program the technology was used to deliver a preceptor model of training to new graduates who were working in small hospitals and/or isolated communities.

Cowell, Kahn, and Bahrawy (1992) reported an evaluation study of a School Nurse Development Program delivered by audio teleconference. The evaluation included a comparison of achievement and satisfaction levels among learners enrolled at off-campus (teleconferencing) and on-campus sites (face-to-face learners). The results indicated no significant difference between the achievement levels of the off-campus and on-campus learners, and a comparison of items concerning satisfaction with the teleconferencing process also indicated no significant differences between on-campus and off-campus learners. In another evaluation study, Connell & Smyer (1986) described the findings of an evaluation of the effectiveness of a telephone conference network to deliver in-service training to staff members at 14 acute and extended-care facilities in Pennsylvania. The vast majority of respondents reported high levels of overall satisfaction with the program format and an interest in participating in additional programs. The telephone network in this project was established under the auspices of a Coordinating Council for Health Care, Pennsylvania State University. This group served as the umbrella organization under which the telephone conference network operated. Institutions could subscribe to the Council and for a fee, which was based on the size of their facility, could be equipped with a conference speaker and a telephone hook-up to connect to the conferences.

Pharmacists have also experienced success with the use of teleconferencing to provide continuing pharmacy education. Roeder's (1983) study reports the results of an evaluation of the effectiveness of teleconferencing as an alternative educational method for continuing pharmacy education. The teleconferencing programs in this study were evaluated by pharmacists for their relevance to professional practice, content, and presentation. The results indicated that the pharmacists found teleconferences to be a convenient and effective method for continuing education, and that the interactive aspect was reported by the participants to be of practical benefit and value.

3.2 Audiographics Teleconferencing

Audiographic teleconferencing is a form of teleconferencing that combines audio conferencing with a personal computer-based visual conferencing system (Kuramoto & Dean, 1997). This particular technology enables the transmission of graphic images and textual information between two or more computers by using a standard telephone service. The system operates like a peripheral network to a normal audio teleconference and allows instructors to enhance the voice-only communications mode with visual imagery. An audiographic system requires the use of a 386 or 486 model personal computer, DOS 3.1 or Windows software, two high-speed modems (9600 baud rate), high-resolution/VGA audiographic software, a high resolution color monitor, a graphics writing tablet, and an audio teleconferencing system that includes several tabletop microphones and a speaker. Using this peripheral technology, teleconferencing sessions can be supplemented and the instruction enhanced by visual information such as graphics, images, charts, x-rays, and still pictures (Picot, 1984).

In one example at the Long Island Jewish Medical Centre, an audiographic system was used to transmit graphic images between various hospitals participating in pediatric grand rounds by teleconference (Rosner, Gandhi & Lanzkowsky, 1992). The telewriter (audiographic) images were sent over one standard telephone line while the actual teleconference occurred over another. The system allowed the creation of color graphics from any video capture source (such as a video camera or a videocassette recorder) or other software package. The electronic tablet was also used for interactive electronic black boarding, so participants could exchange ideas and information on the case presentations.

Teleconferencing Advantages

There are many aspects of audio teleconferencing which make it conducive for many-to-many interactions and the linking of individuals who are separated by geographic distance. The main advantages of audio teleconferencing include:

inexpensive to install, operate, and maintain; uses available telephone technology; a familiar technology and therefore relatively easy to use; and, an interactive medium, allowing direct participant-to-participant interaction.

The primary advantages of audio teleconferencing are cost, convenience, and interactivity. Audio-teleconferencing is one of the least expensive ways to deliver real-time instruction at a distance because it uses minimal equipment and has inexpensive transmission costs (Sternberg, 1986; McDowell et al., 1987; Kuramoto & Dean, 1997; Meyer, 1983). Audio teleconferencing systems are considered natural extensions of the telephone service, and the telephone is very accessible, even in rural and remote areas. Because of this, the operating costs associated with an audio teleconference are relatively lower when compared with other telecommunication-based systems. The main costs are associated with the purchase of equipment and the long-distance telecommunication fees. Other technologies, such as video conferencing, for example, require equipment and telecommunication capabilities which are far beyond what is necessary for an audio teleconference.

In the absence of more advanced technologies, audio teleconferencing is probably the easiest and least expensive means for bridging participants from distant sites. If one has the basic components for an audio teleconference, a place for participants to get together where there are regular telephone lines, speaker phones, microphones and a bridge (if three or more sites are to be involved) then one has the makings for an audio teleconference network. Compared with other distance learning strategies, it requires less technical support and the transmission costs are more economical than audio-visual types of transmission. According to Roeder (1983) in comparison to live continuing education programs, teleconferences can be produced and presented for approximately one-third the cost.

Other advantages of the technology are related to its commonness (Sternberg, 1986) and ease of use. Audio teleconferencing equipment is quite portable and can easily be set up by participants without a great deal of technical support. Most equipment can be connected to a regular telephone jack and many individuals are familiar with the use of telephonic communications, therefore new teleconference users find the technology fairly easy to use.

Hibbard et al. (1986) reported that teleconferencing communication allows for immediate interaction (verbal exchanges) between learners and a distant instructor. This real-time interaction is critical for the establishment and facilitation of dialogue, questioning, feedback and the development and growth of an educational network. Similarly, in Nath, Thomasson, Iverson & Davis' (1981) study and Roeder's (1983) evaluation findings, teleconference participants reported that they were most impressed with the rapid exchange of information between experts and

learners. Because audio conferencing relies heavily on the spoken word it is believed to require close learner attentiveness resulting in refined listening and concentration skills among learners.

Another obvious advantage for participants is that they do not to have to leave their own hospital or community to travel a long distance for continuing education (Synder et al., 1982; Hibbard et al., 1986). Roeder (1983) observed that teleconference programs could be brought directly to pharmacists without disrupting their work day and without the need for them to travel. The lack of visual contact with participants at other teleconference sites can also be viewed as a strength because of the relative anonymity this fosters, which may encourage participation from those who might otherwise be silent at a conventional seminar.

Teleconferencing Disadvantages

The flexibility of audio teleconferencing is countered by the limitations which are inherent to an audio-only communications medium. Because audio teleconferencing is an audio-only form of communication technology there are several limitations: initial resistance until users become familiar with the equipment and how to use it effectively; impersonal because it eliminates nonverbal cues and body language; and restrictions on the type of content that can be delivered in an oral format.

The fundamental limitation of telephone communications is that individuals cannot see each other. In this manner, it can be a very impersonal communications mode because it lacks face-to-face contact or a visual channel of communication (Meyer, 1983). This can often lead to perceptions of remoteness and feelings of unreality towards other participants (Treloar, 1985). As well, because it is difficult to obtain an impression of personal contact, teleconferences may also have a reduced emotional tone which is often of a more serious or businesslike nature than face-to-face communication. Henry (1993) noted that some learners felt they were less a part of collegiate life when they participated solely in teleconferences at distant sites. Henry also found that students who relied highly on visual stimulation for learning reported that they found the medium very frustrating. Some learners and instructors may also experience difficulty in understanding foreign accents which is compounded even further with a lack of face-to-face contact.

In order to overcome these barriers, Treloar (1985) recommends that instructors need to pay close attention to group synergy by promoting group discussion and understanding the time limitations which adults have for concentrating on an audio-only message. It is important to be cognizant that a teleconference can often be perceived by some learners as a disembodied group of voices. However, with appropriate techniques which are designed to humanize the teleconferencing experience, to encourage the sharing of experience, and to vary content delivery and message style this perception can be overcome. A further problem, which stems from the extra planning efforts required for teleconference instruction, is that some faculty find the technology requires greater preparation time and effort. This can act as a deterrent to the willingness of instructors to teach learners using the technology.

Effective instruction, no matter how extensive the planning and preparation, can be disrupted by technical difficulties which can occur unexpectedly in a teleconference. These problems cause a great deal of frustration among learners and faculty alike (Kuramoto & Dean, 1997). The regular telephone system represents a serious limitation to audio teleconferencing. During the past decade or so there have been vast improvements in overall telephone voice quality. Nevertheless, the telephone remains at the lower end of the communication devices which are used to replicate the sound of the human voice (i.e. audiocassette and compact discs). This limitation in quality can challenge the users' ability to hear what is being said and also impede their ability to detect changes in tone, voice inflection, or other ways in which the voice conveys meaning.

Telephone lines, particularly the traditional analog lines of POTS (plain old telephone system) in many rural areas can be subject to conditions such as static, crackling or clipping. These conditions are created by telephone signals as they travel through the twisted copper pairs of wires comprising the POTS networks. These noises can further complicate the conversational dynamics of an audio teleconference.

Other disadvantages focus around instructional barriers because audio teleconferencing cannot be used for teaching strategies that necessitate the demonstration and evaluation of student progress (Henry, 1993).

Teaching & Teleconferencing

There are a variety of techniques which instructors can use to improve and enhance the quality of teaching which is provided through audio teleconferencing. According to Parker & Baird (1977) there are four main design elements which are deemed essential to effective interactive audio programs: building humanization techniques into the audio program; presenting the material clearly and concisely; seeking participation; and obtaining feedback. Kuramoto & Dean (1997) suggest that the instructor should make a conscious attempt to draw students at distant sites into the dialogue in order to promote interaction and counteract perceptions and feelings of isolation which some distance learners may experience. Interaction and collaboration between instructor and students is believed to enhance the learning

process because dialogue enables knowledge construction and understanding, allows information to be situated within a larger context, and an increased level of interaction is believed to produce more positive attitudes towards learning.

Connell & Smyer (1986) recommend that visual aids, diagrams, workbooks, and selected reading materials be incorporated into teleconferencing programs because these materials can serve to focus the attention of the participants. These materials may encompass slides, outlines, bibliographic materials, outlines of activities, and resources which can also be made available for self-directed study outside of the teleconference (McDowell et al., 1987; Parker & Baird, 1977). Well-written program handouts should include a purpose and objectives, an outline of the content to be presented (Treloar, 1985), and must be received by the participants prior to the audio teleconference.

Elsey & McIntyre (1996) suggest a number of means for improving the instructional effectiveness of teleconferencing programs. The authors' experience is largely based on their success with distance learning projects for palliative care workers in rural Southern Australia. Among the many recommendations, one critical element for program success is the existence of a genuine-felt need among rural healthcare workers to sustain and support a distance learning project. Instructors also need to be skilled in facilitating learning, group work, and fostering a suitable climate for collaboration and participation. According to Henry (1993) the strategies which instructors can use to maximize the learning experience include maintaining contact with the distance learners by having them identify themselves before they speak, compensating for the lack of nonverbal cues by using frequent questioning, and fostering socialization among the learners.

Faculty will also need to learn how to use audio teleconferencing equipment in a way that provides the opportunity for interaction (Cowell, Kahn & Bahrawy, 1992) and collaboration. Despite their prior teaching experiences most instructors will still need assistance and more preparation in mastering a bank of skills for teaching at a distance. Instructors should be taught skills for the effective use of the technology and be given substantial professional assistance in the design, production and evaluation of their distance learning program. Group or individual orientation sessions should be organized to enable instructors to become familiar with the use of the technology (Kuramoto & Dean, 1997; Shomaker, 1995).

It may also be necessary to assist some adult learners in becoming comfortable with the hardware and how to use it (Treloar, 1985). By demonstrating its ease of use and providing simple instructions in how it is used, on-site program moderators can assist participants to overcome any initial discomfort with the use of the system. Participants need to be guided by the instructor or a site coordinator to speak clearly and slowly into the microphone (if one is being used). Most participants do become comfortable with the hardware after the first two or three sessions they use it, but this does not automatically result in increased participation and interaction. These are behaviours which the facilitator needs to foster, manage and facilitate by building interaction strategies into their teaching.

Organization & Planning

A major factor which influences the successful implementation of a teleconferencing system involves the user's acceptance of the communications medium (Treloar, 1985). Adult learners and educators may be reluctant to use a new educational communications medium, particularly when face-to-face communication has been the usual mode of delivery. The promotion of teleconferencing as an instructional system and what it has to offer program participants, particularly its ability to provide access to previously unavailable education services, is an important step in overcoming ambivalence. According to Treloar (1985) public relations activities such as displaying and demonstrating equipment, and the writing of briefs about the equipment are helpful strategies to promote teleconferencing systems. In many instances it is very important to gain the prospective hospital site's support for the program. With this approval a local demonstration can be arranged and the benefits and opportunities of a teleconferencing system demonstrated and promoted.

DuGas & Casey (1987) report that the three most critical resources for the successful operation of a teleconferencing network include: a liaison (coordinator) person at remote sites; technical assistance in operating the system; and the instructors. A program coordinator should be designated at each program site to supervise, promote, administer and serve as local contacts for all programs at their location (Connell & Smyer, 1986; Kuramoto & Dean, 1997; McDowell et al., 1987; Parker & Baird, 1977). These individuals may also assist in facilitating discussion, distributing materials, and encouraging participation. An experienced and reliable technical officer is also crucial (Hart, 1989) for managing any technical problems which may arise during a conference, in operating a bridge, and connecting multiple sites.

Instructors play an important role in the planning and organization for teleconferences. If faculty intend on enhancing their presentations with slides, videotapes, and transparencies (which they should be encouraged to do) then arrangements need to be made for these materials to be sent to the sites in advance. The cooperation of faculty is essential in preparing instructional materials well in advance of the teleconference session so that they may be delivered to teleconference sites. Rosner, Gould, Gaschler, Howard & Rarick (1992) describe the importance of timelines for organizing medical education sessions at a distance using audiographic teleconferencing. In their project case histories, physical examinations, lab data, and appropriate pathology slides had to be prepared and stored for transmission well in advance. The day before each conference, all hospitals were called, workstations were connected by telephone, and the data pages downloaded. It was only through the cooperation and commitment of instructors that the materials could be received in advance to be distributed to the various sites.

Budgeting, faculty selection, marketing, registration of students, and teleconference site selection are some of the other administrative and organizational concerns that must be addressed during the preparation of a course for audio teleconferencing (Henry, 1993). The availability of funds for equipment transmission costs, faculty salary, and the purchase of equipment need to be considered as well. Teleconference locations which are central to the target population are important and need to be scouted. Hospitals, schools, community colleges, and church classrooms can be used as potential teleconference sites if phone lines are available. The teleconference room itself should be self-contained, designed to keep outside noise to a minimum, and provide sufficient space to comfortably accommodate the number of participants expected.

The success of teleconference programs, like all educational sessions, are also directly linked to the extent to which program topics address the learning needs of participants. In Synder et al.'s (1982) study the needs of participants were partly addressed by ensuring their active involvement and participation in program planning processes. An advisory committee was also established and met bi-annually to consider needs assessment information and to identify topics and speakers for the teleconference programs. Gelmman & Franke (1996) reported that needs assessments were done twice yearly for their teleconferencing programming to ensure that topics were relevant to the practice needs of the participants.

3.3 Radio

According to Herman & Buerki (1977) the first reports of the use of radio to augment continuing education activities were in 1955 when the Albany Medical College began broadcasting programs to physicians and pharmacists at a distance in the northeastern US. Using a FM (frequency modulation) radio station, staff at the Medical College delivered one-hour presentations to participants in several New England states. Using a special telephone hook-up the presenters could also hear questions from participants and provide live answers which allowed for minimal site-to-site interaction. As a result of these early efforts and the success with radio broadcasts the Albany College conducted an invitational conference to make other medical schools aware of the effectiveness of educational radio.

Other universities followed suit and similar radio programs were developed by the colleges of medicine at Ohio State, University of California, University of North Carolina, University of Utah, University of Wisconsin, and the University of New South Wales. In 1971, the Division of Extension Services at the Albany College of Pharmacy, in cooperation with the Albany Regional Medical Program, also decided to arrange radio programs for pharmacists (Griswold, 1972). At that point in time, 52 hospitals in 27 counties in the region were equipped with receiving and sending equipment to connect with the radio transmissions.

Radio technology has also been used to deliver continuing education programs in Australia and Europe. In Australia, a radio network covering most of the isolated parts of the continent has enabled the majority of remote nurses to access regular ongoing continuing education (Thornton, 1986). In Finland, the Finnish Centre of Continuing Pharmaceutical Education, together with the Finish Broadcasting Company and the University of Kuopio arranged a radio series in 1990 for pharmacists and pharmacist assistants (Savela & Enlund, 1996). An evaluation survey of the program series indicated that 57% of the respondents had listened to some of the programs. The most common barrier to listening to the transmission was an unsuitable broadcast time. A large number of the respondents to the survey felt that the programs were useful to them, but the lack of opportunity for interaction with instructors and other participants was reported as the main problem with instruction by radio.

Despite some limited success with the radio technology there are serious challenges to its effectiveness as a medium for facilitating learning. As a distance learning technology, radio often suffered from a lack of "comfortableness" that was associated with live-seminar programming, and the contemporary glamour ascribed to computer-assisted instruction, closed-circuit television, audio and video cassettes. Moreover, the paucity of substantive research on radio as an acceptable and effective vehicle for the continuing education of health professionals slowed its growth substantially. The greatest challenge to radio was found to be the development of the interactive technology of audio teleconferencing which enabled presenters and participants to interact and communicate with one another in real-time.

3.4 Audiotapes

According to Oakley (1983) the "ideal" tool for the physician, especially the one practicing in a rural area far removed from the medical teaching center, would be a learning instrument he or she could utilize anywhere and at anytime. The audiocassette has been touted as that ideal tool because it offers professionals the opportunity to study at their convenience and at a pace of their own choosing (DeMuth, 1996; Goldstein, 1972). The main advantages of cassette tapes are that

lectures can be prepared, recorded and delivered by any expert in the health sciences, and in comparison to other education technologies like televised lectures, tapes can be replayed at the discretion of the listener (Goldstein, 1972). Audio tapes offer a high level of portability, users can readily review information, and the recorded information on the cassettes can be supplemented with printed materials such as instructional outlines, diagrams or charts.

The audiocassette is also a teaching tool that can be used at many locations where time is otherwise wasted, principally during automobile commuting. The cassettes are small plastic enclosed devices which house miniature reels containing magnetic tape which is 1/8 inch wide and varying in length (60, 90, 120 minute). They can be placed in standard or miniature cassette player-recorders and are activated simply by pushing a button. Audiotapes are inexpensive, easy and cheap to distribute, and can be used while driving, walking, or relaxing at home.

Extension Services in Pharmacy, the University of Wisconsin appear to be the pioneers and leaders in the use of audiocassette programs for continuing education. According to Blank, Kirk & Weinswig (1975) the introduction of audio magnetic tapes as an independent study technique provided pharmacists with an opportunity to continue their education without the need for travel, and at the time, place, and pace they chose. The Extension Services division has developed several audio cassette courses, each course consisting of seven or eight tapes of one hour in length, a notebook with lecture outlines, diagrams and case histories, and self-assessment tests. An evaluation study of the effectiveness of these audiocassette programs revealed that they increased knowledge gain and pharmacists were generally satisfied with the materials and the learning experience. In Blank et al.'s (1975) study, pharmacists' achieved a mean pretest score of 54.7/100 and a mean posttest score of 79.5/100. A large number of the participants also indicated they would recommend the technique to a colleague and 94.8% expressed an interest in future participation in such continuing education programs.

In another study, DeMuth (1996) also reported the results of an evaluation of the effectiveness of an audiocassette program for providing continuing education to pharmacists. One hundred and forty five pharmacists responded to an evaluation questionnaire, a response rate of 65.3%. Ninety three percent of the respondents considered the program to be a valuable learning experience; 85.7% considered the method a convenient and time saving means for professional continuing education; and 84.1% indicated that they would recommend the program to a colleague. However, despite the reported success with audiocassette programs the technology is considered to be a very passive medium for facilitating learning. The main challenge is related to the fact that there is no opportunity afforded by the medium for engaging in learner-to-learner interaction or communication. These devices basically serve as a means for distributing information in a verbal format for learners to review and listen to at their own leisure.

4.0 Video-Mediated Learning Technologies

4.1 Introduction

Video-mediated distance learning can include either synchronous or asynchronous technologies. Videoconferencing, or interactive television, technologies comprise the main synchronous forms of video-mediated distance learning. They are considered synchronous because there is the opportunity for live visual and verbal interaction and communication between instructors and learners. Asynchronous instructional video tools include those technologies which transmit static or still imagery, and offer limited opportunity for live interaction if any, between learners and instructors. Some examples of the asynchronous video-mediated technologies include slow scan video, interactive videodiscs, and videotapes.

In the following sections a variety of case and evaluation research studies pertaining to the use of video-mediated instructional technologies will be described and discussed. This discussion will examine each of the technologies, advantages and disadvantages, and provide an overview of their use in the continuing education of health professionals at a distance. The main video-mediated technologies discovered by the literature search included videoconferencing (or videoteleconferencing and interactive television), broadcast and closed-circuit television networks, slow scan video, and video-based satellite broadcasting. In more recent times, extensive interest has focussed on the use of videoconferencing technology for telemedicine consultations and the provision of distance learning opportunities for health professionals. It is this video-mediated technology which is explored first.

4.2 Videoconferencing

Videoconferencing technology has rapidly emerged as an increasingly useful tool for improving patient care delivery and expanding access to continuing education for health professionals. As pressure mounts to reduce health care delivery costs and to increase access to quality medical care, the efforts of many individual hospitals, regional health care systems, and governments to install interactive videoconferencing systems has quickly been intensifying (Brown, 1994). The emergence of the relatively inexpensive compressed video systems that permit two-way video and audio interaction has increased the acceptance of this communications modality in situations where face-to-face instruction was the established norm.

Videoconferencing, also known as videoteleconferencing and interactive television, is a presentation mode that can link an instructor and adult learners at various remote sites using a two-way audio and video connection (Havice & Knowles, 1995; Kaufman & Brock, 1998; Sen Cupta, Wallace, Clark & Bannan, 1998; Brown, 1994). Videoconferencing systems have experienced significant growth in recent years because of increased digital transmission options at reduced costs, vast improvements in video compression technologies, and improvements in the systems with an associated decrease in their cost. The main interest in videoconferencing is based on the interactive, real-time two-way communication which it permits. This enables instructors to receive immediate feedback from participants allowing them to adjust their presentations accordingly (Fairbanls & Viens, 1995; Burleson & Sugimoto, 1984). Video transmissions appear on a monitor, much like a traditional television, while sound emanates through the system's speakers. The signal transmission is usually so rapid that the sender and receiver can interact in a simultaneous manner.

The communication transmission can be of two types: point-to-point or multipoint. In a point-to-point transmission, the communication and interaction occurs only between two sites. Multipoint videoconferencing involves more than two sites and is accomplished by using a bridge which links the various locations. The bridge also functions to recognize the venue that is initiating communication, allowing that particular audio/video signal to be transmitted to all other sites. Videoconferencing systems enable the use of a variety of presentation aids, such as slides, graphics, audio and videotapes, models, specimens, x-rays, and CAT scans (Kalisman, Wendorff & Millendorf, 1986). The greatest strength of this technology is its ability to reach audiences over a broad geographic area despite their isolation or distance from urban areas. This is advantageous because it cuts down on the time to travel to continuing education programs and the associated costs.

Videoconferencing is typically delivered using either satellite, fibreoptic cable, or regular telephone line connections. Satellite transmission involves the beaming of a signal from a videoconferencing studio to an orbiting telecommunications satellite from where the signal is beamed to reception sites at remote universities or hospitals (Devaney, Peterson, Martin & Collier, 1996). This method can be very expensive, particularly if land-based telecommunication networks are available. Fiberoptic cable is a more cost-efficient means of transmission and is made up of multiple glass strands each the size of a human hair. These cables can carry over 100 video channels, but their use is highly dependent on whether fiberoptic cable infrastructure is available in an area. In most rural and remote areas the infrastructure for fiberoptic cable is not available. In these instances, videoconferencing can be accomplished over telephone lines using switched digital technology and a piece of computer equipment called a codec.

A codec uses video compression technology to squeeze the vast amount of information contained in a video transmission, and its accompanying audio signal, onto a smaller carrier. After the encoding and compression processes are complete, the resultant data is transmitted to the remote end of the videoconferencing link where the digital signals are then decoded into analog video and audio (Ball, 1994; Fairbanks & Viens, 1995; Brick & Schreiber, 1993; Sen Cupta et al., 1998; Brown, 1994; Benschoter & Benson, 1992). The capabilities of various codec devices are brand name and bandwidth dependent with best results being obtained by some manufacturer's proprietary algorhythms (computer compression and decompression programs). Recent breakthroughs in compression technology and coding techniques allow for the transmission of acceptable picture quality, at near broadcast quality, with capabilities for generating 30 fps (frames per second) and up to 480 TV lines of resolution (Brown, 1994). Physicians who use videoconferencing for medical consultations or for CME typically use transmission rates of 384 kbps (kilobytes per second), 768 kbps, or the full T-1 rate of 1.544 mbps (megabytes per second) (Brown, 1994).

According to Kalisman et al. (1986) the equipment required for videoconferencing does not need to be massive nor expensive. Rolling units are available that can turn any conference room into a video conference facility quickly and easily. On the higher end of the price scale are more elaborate, more-permanent types of conference installations with built-in permanent teleconferencing centers that can be situated where there is an existing and frequent need. Most videoconferencing vendors have three levels of configurations: desktop systems (under $2,000), portable systems ($20,000), and conference room systems ($50,000) (Kaufman & Brock, 1998; Straub, 1997).

Desktop systems run on a personal computer (minimum 486 with 16 Mb RAM) using the appropriate software and a video camera, and can use analog phone lines (POTS) (Sen Cupta et al., 1998). These systems typically provide video quality from five to 30 fps, very acceptable quality depending on the type and nature of communication. However, for higher quality video transmission these systems will require a connection to a digital line such as an Integrated Services Digital Network (ISDN), Switched 56, or fractional T1. Desktop, or personal computer based (PC based) systems are newer, cheaper, and more mobile than portable and room-based systems.

Portable systems house a complete videoconferencing system in a cabinet or cart with wheels and are designed for small to medium-sized groups. Conference room-based systems involve a dedicated unit which is bulkier than the other system types, and generally more expensive. The main advantage of these systems is they can produce very high quality images, depending on the bandwidth used (Sen Cupta et al., 1998; Kaufman & Brock, 1998). Each conference room on a videoconferencing system or network requires cameras and display monitors, control systems, audio equipment, as well as the proper network access. Room-based systems generally include more peripherals than portable systems and are more customized to specific applications. A variety of additional equipment can be integrated with or function alongside the videoconferencing equipment. This equipment can include: additional monitors for viewing high-resolution graphics; high-resolution cameras with magnification capability for close patient examination and scrutiny of images; high-resolution scanners for X-ray input; miniature cameras for attachment to biomedical scopes; electronic stethoscopes with aural receivers; and EKG machines.

Several studies in the literature have examined the effectiveness of videoconferencing in delivering continuing education programming to health care professionals in rural, remote and isolated areas. In one study, Jarrett, Wainwright & Lewis (1997) reported a project in which rural general practice nurses participated in distance education using videoconferencing. The authors reported that the intended learning outcomes of the training sessions were reached and although initially apprehensive, the nurses quickly became accustomed to the medium. Latchem & Rapley (1992) also encountered success with videoconferencing for continuing nursing education at the Curtin University School of Nursing. A majority (94.9%) of participants described the sessions as very useful, enjoyable (75.7%), and 85.6% considered the quality of teaching via this medium superior or comparable to normal lectures.

In another project, Nichols, Beeken & Wilkerson (1994) described a project at the University of Wyoming in which the effectiveness of continuing health professional education via videoconferencing was evaluated. The authors reported that the transmission of the signals over existing telephone lines made videoconferencing more versatile and less costly to install when compared to microwave or satellite transmission. The results of the study indicated that the learners who received instruction through videoconferencing achieved to levels equal to face-to-face learners. Social interaction between learners and instructors was also shown to be promoted and effectively facilitated through the technology.

In a study designed to investigate the effectiveness of videoconferencing for CME, Langille, Sargeant & Allen (1998) used the technology to deliver CME to four communities in Nova Scotia. The outcomes of this study indicated that physicians and faculty were very enthusiastic about their involvement in this type of CME programming. Participants were very satisfied with the programs and a majority felt that the format was as effective as face-to-face CME. The authors noted that some difficulties were experienced with the video and audio transmissions, but that these were mostly related to technological aspects of the programming and could be improved upon.

Savela, Lilja & Enlund (1996) described a study in which two-way videoconference transmissions were used to deliver continuing health professional education to several sites in Finland. The results of a questionnaire distributed to the participants, both before and after the events, indicated that the participants' attitudes towards this form of education changed mostly in a positive direction. Gruppen, Hutchinson, Gordon & Roser (1996) also reported the results of an evaluation of the effectiveness of videoconference broadcasts on topics in oral and maxillofacial surgery. The results of this evaluation suggested that educational videoconference broadcasts could have a substantial impact on the knowledge and attitudes of residents, faculty, and medical practitioners. Participants showed statistically and educationally significant increases in knowledge levels which were directly attributable to the videoconferences. Hampton, Maxmanian & Smith (1994) also found that rural physicians receiving CME by videoconferencing displayed a 21 % increase in knowledge gain between pre to posttest achievement measures.

The interactive nature of videoconferencing is reported to be one of its main strengths. However, interaction does not necessarily transpire because the technology enables it, two-way communication and discussion must be facilitated by an instructor. As an example, in Byers, Hilgenberg & Rhodes (1995) study, despite a large number of participants reporting that the ability to receive feedback from the speaker was an important aspect of the technology, a large majority failed to make use of the interactivity or to ask questions of the instructors. The authors did note that learners became more comfortable with the technology after attending more than one session and physicians felt that the technology made it possible to attend many more programs than would have been possible if they had to take time away from their practice.

Whitten et al.'s (1988) study is one of the only to use a rigid experimental design to evaluate the effectiveness of videoconferencing in the continuing education of health professionals. In this study, a comparison between physicians' perceptions of the effectiveness of CME programs delivered by interactive television (ITV) and traditional face-to-face workshops was conducted. The results of the study indicated that there was little difference between the perceptions of learners participating in either face-to-face or ITV. The ratings of the interactive television program were very high, suggesting participants were very satisfied with their learning experience through that technology. However, Whitten et al.'s study, like many of the others lacked a systematic approach to evaluating the effectiveness of the instructional technologies for enhancing learning or affecting the performance of physicians in their clinical setting. Whitten et al. (1988) did acknowledge this weakness and suggested that future evaluation efforts should focus on the examination of learning and retention among learners in ITV programming as well.

4.3 Broadcast and Closed-Circuit Television

The methods for transmitting health sciences information and continuing education via broadcast TV have been basically in three modes: 1) open-circuit (also known as broadcast) systems; 2) scrambled image systems; and 3) closed-circuit systems (Sanborn et al., 1973). Broadcast television is a video-mediated instructional system which allows for one-way video and audio transmissions to multiple receive sites. The broadcast usually involves the use of a microwave system to transmit audio and video via high frequency signals from one send site to another receive site. The maximum distance for transmission is around 50 miles and a microwave system requires the use and/or installation of large towers, antennae, and special communications cable (Havice & Knowles, 1995). An alternative to the use of microwave technology is to broadcast instructional programming through a cable network such as a community channel or public broadcasting system. The main limitation inherent to these forms of distance learning exists, in the one-way video and audio broadcasts which are carried. Unless a second line of communications is made available, either through a telephone or audio teleconferencing connection, there is limited opportunity for interaction between instructors and adult learners at the various sites.

A survey of the literature which has compared TV with conventional learning situations indicates that there is no significant difference between learning outcomes from television and the traditional face-to-face classroom. However, there were no studies in the literature which suggested that changes in physicians' or nurses' behavior were found to have occurred as a result of participation in an educational program on television (Caldwell & Brayton, 1974). The literature does indicate extensive use of broadcast television during the 1970s to deliver continuing education to health care professionals. According to Caldwell & Brayton some of the first applications of television in medical education occurred in the late 1940s, and since that time at least 50 televison production facilities based in universities or teaching hospitals have been established. One of the first leaders in the field was the Medical Television Network (MTN) operated by the University of California Extension, Los Angeles (UCLA). MTN began its medical education network with weekly broadcasts of continuing education programs to practicing physicians and nurses in 72 hospitals in Southern California using a scrambled (encoded) broadcast system.

In Canada, broadcast television appears to have roots which extend back to the late 1960s. Hunter & Portis (1972) reported a broadcast television project at the Faculty of Medicine, University of Western Ontario which conducted continuing education programs for the approximately 2,200 medical doctors in southwestern Ontario. It was estimated that between 900 to 1,000 viewers watched at least one of the 1968 broadcasts, and half of these could have been regarded as regular viewers. Unfortunately, the instructional quality of the broadcasts were not rated very highly and viewers did not feel that the full educational potential of the medium was being fulfilled. The physicians who did watch the broadcasts tended to be frequent viewers and were those who generally acknowledged difficulty in keeping abreast of current medical information.

In other examples from the United States, an open-channel educational television series called "Monday for Medicine" was produced and telecast by the University of Minnesota College of Medical Sciences and the Mayo Clinic between 1967 and 1970 (Fahs & Miller, 1970). Physicians in general practice rated the importance of the program to a higher extent than other physicians, and the scientific composition of the programs was judged to be adequate, reliable, and accurate. A major weakness of the program was it could not retain viewers' interests for any sustained period of time. Television broadcasts, because of the one-way transmission of information, required a disciplined viewer, and such discipline was difficult to develop at the end of a tiring day of work when the broadcasts took place.

A leader in nursing education at a distance, the Intercollegiate Center for Nursing Education (ICNE) based in Spokane, Washington has been using broadcast and cable television to deliver continuing education telecourses since 1980 (Clark, 1989; Kaufman & Brock, 1998). The participants in these programs received printed materials to supplement the on air transmissions and were able to request continuing education credit by completing and submitting end-of-unit examinations for correction. Programs were originally broadcast via several cable franchise channels on the state public broadcasting system(PBS). These programs were live productions, so participants in the workplace could interact with faculty members in the classroom by a telephone in a one-way video, two-way audio loop.

In the fall of 1990, ICNE was connected to the Washington Higher Education Telecommunication (WHET) system (Dirksen, 1993), a two-way, land-based microwave television network that was both video and audio interactive. Microwave communication towers were erected at strategic locations in the state of Washington to enable "line-of-sight" for microwave transmission. Occasionally, high winds or electrical storms caused transmission problems by disrupting the receiving and relay antenna, but for the most part there was a great deal of satisfaction with the system. According to Clark & Cleveland (1984) broadcast television has enabled ICNE to address some of the problems that nurses have experienced in gaining access to continuing nursing education by bringing it to their homes and work settings.

In continuing pharmacy education an editorial in the journal American Pharmacy (1990) reported on the series "Pharmacy Rounds" which premiered on Lifetime Medical Television in July 1990. The program, presented by the University of California (San Francisco) School of Pharmacy (UCSF), enabled qualified pharmacists to receive continuing education credit by taking an exam, obtainable through a 800 number, based on content from the series. Each program was funded by a corporate sponsor and topics covered in the series were selected by an advisory board of pharmaceutical experts.

According to Marshall & Alexander (1972) much of the literature describing CME television projects reveals that many of these efforts were mounted without much attention to what could be learned from them. As a result, we know too little about the benefits of television to use it optimally and too little about its drawbacks to avoid them. Broadcast television as a tool in CME has been regarded as an "advertisement". Its impact is relatively superficial, so television presentations should be designed to encourage the viewer to seek additional information, whether from print sources or from attendance at traditional CME courses. The main recommendations which Marshall & Alexander suggest for television as a distance learning medium is that it should be used to introduce, summarize or present a case study. Detailed material is better left to print material or to a traditional course structure.

Closed-circuit television systems utilize a localized (closed) broadcast network for transmitting one-way audio and video information and are usually located within a given institution or geographic region. Tribulski & Frank (1987) described a project which used a closed-circuit television system in a hospital setting, already in place for patient education, as a means for providing continuing nursing education. In this project a computer-controlled director was used to play a stack of video cassettes in a variety of programming areas. The video cassette topics were based on formal and informal assessments of the nurses' learning needs. Educational credits were issued for viewing the videos and completing a posttest. The authors noted that an increase in positive attitudes towards self-directed learning was observed following the introduction of the system.

In another study, Sanborn et al. (1973) also reported the results of an evaluation on the use of closed-circuit television for continuing nursing education. In this study the findings from attitude rating scales, preference rankings, and a questionnaire indicated that nurses who frequently utilized the medium accepted it more than nurses who used it less. However, the lack of opportunity to raise questions and participate in interactive discussion was believed to have reduced the effectiveness of learning from television (Sanborn et al., 1973).

In 1973, the Division of Continuing Education at Louisiana State University (LSU) School of Medicine launched a monthly two-hour closed-circuit CME television program (Stephens, 1974). The program was produced and broadcasted live to over 20 hospital viewing locations via the statewide Louisiana Hospital Television Network (LHTN). The network had a two-way talk back system which allowed viewers to comment and ask questions on the air. In another commentary in Technological Horizons in Education (1983) the Emory Medical Television Network (EMTN) is described. EMTN provided medical institutions in the Atlanta area with educational programs through its ITFS (Instructional Television Fixed Services). ITFS was a closed circuit, two-way TV system that allowed an audience in diverse remote locations to view, via TV, lectures and intricate demonstrations. The network was self-supporting and broadcasts included 3 hours of live, full-color programming.

4.4 Slow Scan Video

According to Kalisman et al. (1986) slow scan video is one of the most inexpensive and convenient methods of communicating visual information for telehealth consultations or the continuing education of health professionals. Slow-scan video transmission has been used in several projects as a means for delivering CME to rural health care providers. Slides, x-rays, EKGs, skin lesions, cardiograms, CAT scans, and other medical diagnostic imagery can be transmitted over one telephone line, while simultaneous conversation between two or more persons at multiple sites is facilitated over another (Dunn, Acton, Conrath, Higgins & Bain, 1980; Dunn and Fisher, 1985; Sanders, Brucker & Miller, 1995). This "freeze frame" video-mediated technology operates by taking an image from a television camera, freezing it in stop-action, condensing the image into an audio signal and then transmitting it along standard telephone lines. At a receiving site the image is expanded and displayed onto a monitor. A variety of narrowband technologies including voice-grade telephone lines, data communication lines, microwave, or satellite carriers can be used as the transmission vehicles.

A basic slow scan system at a transmitting site consists of a standard television camera coupled with a television monitor, a telephone with transmission lines, and a slow scan unit. At the receiving site only a telephone, television monitor, and a slow scan unit are needed. The system can be as simplistic as a point-to-point send/receive network, or it may be a very complex interlinked system, connecting multiple locations for interactive transmission. Complex systems that utilize multiple locations, each of them capable of sending and receiving images, will need to be linked together by an audio bridge.

In one project a slow scan system was introduced into the Sioux Lookout Zone in Northwestern Ontario in 1977 for telemedicine consultations and continuing education (Dunn & Fisher, 1985; Dunn et al., 1980). The Sioux Lookout was a sparsely populated and large area with approximately 27 communities ranging in size from 25 to 1000 people. None of the communities were large enough to support a full-time doctor and only 7 of the larger communities with populations of 350 or more had a nursing station. The slow scan system introduced to the region had two components, voice was transmitted by one telephone line and the video picture on a second. Conference calls for both the audio and the video were arranged so that interactive multisite programs could be offered. During a 5-year period from 1975 - 1978 more than 300 educational programs for doctors, nurses and other health care professionals were presented using the slow scan system. The main findings from the project were that the availability of video on an ongoing, immediate basis enhanced the learning environment and was of immense assistance in explaining the clinical material that was being presented. The technology was also found to work best with small groups of learners.

The Telecommunications Information Network (TIN) at the University of Cincinnati Medical Center evaluated slow-scan (narrow-band) television as a means of providing medical information on demand to health-care professionals at remote hospital sites (Lorenzi, Kues & Anthony, 1984). The slow-scan network was used to create a link between four remote hospitals and the Medical Center, providing health care professionals with access to library and nonlibrary resources. The use of slow-scan television for the delivery of printed information was a significant improvement over the interlibrary loan system because information could be transmitted in a very timely fashion. However, according to the authors the major problem with the slow-scan equipment they used was related to the small amount of material that could be successfully transmitted at any given time. Only two or three paragraphs from a standard journal page could be transmitted per frame, necessitating multiple transmissions for each page. Another problem was the amount of time required per transmission. Over seventy-five seconds was required for material to appear on the monitor at the receiving site,and the time of set-up (turning pages and resetting camera focus) increased transmission time considerably (Lorenzi et al., 1984).

4.5 Satellite TV

Satellite television is best described as a delivery system in which educational programs are transmitted via a satellite and received by a dish rather than by a rooftop antenna or a cable network (Nierenberg, 1987; Young, 1995). Many hospitals have subscribed to satellite networks to provide programming to meet the educational needs of health care professionals. Using a satellite relay transmission, an instructional session (live or on tape) can be coded and transmitted from a studio through an up-link earth station to a satellite located 22,300 miles above the earth. Located on the satellite are transponders which re-transmit the coded signals to a satellite footprint (that is the geographic transmission area covered by the satellite). A satellite dish, or downlink, usually on the roof of the hospital, receives the signal which is then decoded and viewed on television monitors.

In Canada, the earliest uses of satellite date back to the 1970s when the technology was used in the delivery of CME to physicians in rural and remote regions. Chouinard's (1983) study of satellite technology, and its application in education and telemedicine, outlines the Anik A-1 and Hermes satellite projects of the 1970s in Canada. Launched in 1976, the Hermes satellite was, at the time, the world's most powerful communications satellite, providing telemedicine, tele-education and direct broadcasting to Canada's northern, rural, and remote areas. Several projects were piloted using the Hermes satellite, including numerous telehealth projects. A two-way audio and video link between the Moose Factory hospital and the University Hospital in London, Ontario enabled the facilitation of continuing education and telehealth related communications and consultations. However, the experiences of the Ontario project, and similar others in Newfoundland and British Columbia, suggested that satellite technology was not always the most effective nor efficient means for providing distance learning and telehealth links.

In 1977, the Health Sciences Centre of Memorial University of Newfoundland made use of the Hermes satellite to link to four peripheral hospitals via one-way video and two-way audio communications. CME programming was provided from the Faculty of Medicine to remote health care practitioners using the satellite technology as the transmission medium. Over 150 hours of successful programming demonstrated that one-way television and two-way voice provided an ideal interaction for CME programs. However, the live video transmissions were expensive and "talking heads" were not judged as necessary to meet the instructional objectives of many of the CE programs. CME staff at Memorial University concluded that it could meet programming needs more efficiently with an audio system which was supported by visual materials such as slides, lecture notes, and other printed handouts. According to Chouinard (1983) the results of the Memorial experience clearly suggested that satellite technology was often not the most efficient means where other simpler and more cost-effective modes of technology were available.

In the 1980s pharmacists in British Columbia were also delivering continuing education using satellite technology. Live educational programs were transmitted by the Anik B satellite, an offshoot of the Anik A-1 satellite experiments, to a number of communities in BC, the Yukon, and Alberta (Fielding & Dinning, 1981). Receiving sites were located at community colleges or community cable television stations which were equipped with television sets for viewing and telephones that permitted the pharmacists to speak directly to the instructors. Presenters in these programs found the absence of learners in the room in which they were teaching difficult and challenging. The learners who were surveyed felt that the quality of the programs was satisfactory and that they would enrol in future satellite-delivered programs.

Benschoter & Benson (1992) of the University of Nebraska Medical Centre used NEBSAT, a state-owned satellite and fibre-optic television system, to transmit several types of educational presentations to rural Nebraska health care professionals. The backbone of the system was a transponder on the Spacenet III satellite which provided the capability for simultaneous broadcasting on three networks: a broadcast quality TV channel used to transmit ETV programming and public radio; a second broadcast quality channel for state-wide distribution of distance learning and continuing education programs; and narrow-band channels for compressed video distribution. The compressed video distribution channels permitted twelve one-way or six two-way connections between origination and reception sites at educational institutions possessing the required hardware.

According to Cervinkas (1984) it is clear that the potential and effectiveness of using telecommunications systems for health applications has been demonstrated for many years. However, the reach of projects which were attempted appear limited because of the use of terrestrial systems. In many remote regions, the population is so sparse or the terrain so rugged that the cost of developing ground-based networks is simply not justified. The advent of satellite technology enabled the refinement of the old technical concepts to make health care at a distance truly feasible. Cervinkas notes that the main advantage of satellites is their ability to link points separated by vast distances and mountainous terrain without additional costs. However, while satellite transmission costs do not vary with distance, the initial capital outlay for satellite installation is considerable, thus land-based communications systems which are already in place may be generally more economical than the introduction of a satellite network.

Several examples in nursing education have also demonstrated some success with satellite broadcasting. In 1988, the University of New Mexico College of Nursing began offering courses in their BSN degree completion program to rural nurses using a satellite delivery system (Shomaker, 1997). Evaluation results suggested that nurses studying at a distance achieved as well or higher than their on-campus peers, and a majority of the off-campus students were amongst the highest achievers of both on and off-campus students. A large majority of students rated the satellite television experience as very satisfactory and both graduates and their employers perceived positive changes attributable to the educational programs. Of the UNM students participating in the distance education program, less than 2% have left their rural communities after graduation, and supervisors have commented that the greatest benefit of the program to the community was in helping to retain nurses.

The University of Texas at Arlington School of Nursing (UTSAN) (Sherwood, Armstrong & Bond, 1994), the Mayo Clinic (Tangalos, 1997), and Texas Tech MEDNET (Moore & Coker, 1992) have established or used satellite systems for providing increased access to distance learning programs for rural health care providers. At the Mayo Clinic, the satellite network has been used for patient care, administrative support, and educational programming. The Texas Tech MEDNET uses satellite television to help rural health care providers overcome their sense of professional isolation by providing continuing education, patient consultation, and health care information. In another example, Nierenberg (1987) described the Hospital Satellite Network (HSN), a satellite network which provided 24-hour a day programming for health care professionals.

4.6 Videotex

Videotel, the name for the Italian videotex system, is a video-mediated technology which encompasses the telephone system and a videotex receiver (TV adapter). Videotel databases provide the capability for sending and receiving personal messages through a mailbox service making it possible to not only exchange messages with colleagues, but to also allow a continuous flow of educational information to a learner. Compared with a computer, Videotel is graphically poor, and although graphic editing is possible, definition is severely limited. Piga, Graziano, Basconi, Giuseppe & Cellerino (1995) evaluated the technical capacity and didactic efficacy of the Videotel system as a vehicle for CME. The educational content of the database was made up of interactive lessons covering several fields of internal medicine and oncology. The structure of the system enabled clinical problem solving and individualized self-assessment by multiple-choice questions (MCQs) or true/false questions. Despite the interest shown by physicians, very few actually made any use of the didactic database. The main reasons for lack of use were related to lack of time, unfamiliarity with the system and how to use it. Other than this study, there were no other reports of the use of videotex systems, like the Italian example, discovered in the literature.

4.7 Advantages

According to Dawes (1998) distance learning enables continuing education providers to accommodate the lifestyles and work schedules of rural health care providers who desire formal learning opportunities. It allows providers to reach those geographically dispersed adult learner groups who might not otherwise be able to attend a continuing education program (Sherwood et al., 1994; Lorensen & Schei, 1992). Distance learning also frees many adult learners from the restrictive confines of the traditional classroom setting, allowing many to study on an independent schedule, while also encouraging the opportunity for self-directed study.

One of the main advantages of video-mediated technologies, like many of the other distance learning technologies, is related to the reduction in costs associated with attendance at educational events. The use of interactive videoconferencing can significantly reduce expenses related to travel and accommodations for learners and faculty alike (Ribble, Moore& Bailey, 1983; Byers, Hilgenberg & Rhodes, 1996). This reduction in travel and time away from the clinic or hospital also offsets the need for locum or replacement staff for those individuals who are traveling.

Rasmussen (1998) reports that video-mediated technologies can enable the uniform delivery of educational programming to multiple sites, the ability to deliver information in a timely manner, the ability to visually portray best practices for all to see, and an added measure of convenience for end-users. Participants can be offered the opportunity to participate in educational activities which are developed and presented by distinguished faculty (Byers et al., 1996), programs they otherwise might not be able to attend. As well, videoconferencing offers an ideal medium for the dissemination of content that would benefit from timely distribution and visual presentation to geographically dispersed audiences. Kaufman & Brock (1998) believe that the main strengths of videoconferencing are related to this capability, that is the transmission of instruction on important and time-sensitive topics in a simultaneous manner to a number of rural health delivery sites at the same time (or within a relatively similar time frame).

Another advantage of videoconferencing exists in its capability for conveying live two-way audio and video interaction. Instructors and learners can see and hear everyone at all conferencing locations (Havice & Knowles, 1995; Byers et al., 1996). This interactive element allows faculty and learners to see and talk to each other during a transmission, which minimizes the impersonal nature and the potential for misinterpretation inherent in other forms of distance education (Weber & Lawlor, 1998; Limon, Spencer & Henderson, 1985; Fairbansk & Viens, 1995; Savela, Lilja & Enlund, 1996). The live, interactive discussions between content experts at the origination site and audiences in geographically distant locations can also enhance learning by: fostering active involvement; providing immediate feedback to learners which enables them to receive clarification when it is needed; and allowing teachers to evaluate whether students needs are being met through the observation of nonverbal behaviour (Byers et al., 1996; Latchem & Rapley, 1992).

Begrvik & Gammon (1997) suggest that videoconferencing sessions can be facilitated and structured to foster a warm and safe atmosphere, and a climate which is open for emotional expressions. In their study, learners were very satisfied with the non-verbal communication which was exhibited through videoconferencing. Further, participants who made up the learner audience at the origination site also enjoyed the opportunity of participating in the conference while being able to see it live.

4.8 Disadvantages

According to Ribble et al. (1983) several challenges appear to exist in gaining faculty acceptance of and involvement in the delivery of video-mediated distance learning. Increased preparation time and effort are usually required of faculty in order to teach courses using videoconferencing, broadcast television, or videotaped instruction (Hoeksel, 1994; Dirksen, 1993). Many of the problems are related to workload, specifically the new demands placed on faculty to meet the increased preparation time associated with the new teaching strategies. In Sherwood et al. (1994) study faculty reported a 2 to 3 hour preparation time for each broadcast hour to develop content outlines, graphics, and lecture materials.

Video-mediated instruction can also result in instructional projects which are expensive,complex, and require the use of complicated technology. Because of these challenges a great deal of administrative effort and the need for well-trained technical personnel are usually required to bring about a successful program. The purchase of hardware, the leasing of transmission lines, and the actual costs of transmission are further expenses associated with the delivery of videoconferencing sessions (Billings et al., 1989). According to Fry, Baer & Cornett (1976) many of the economic factors related to the cost of operating a video-based transmission system can only be overcome with an adequate volume of use through a combination of medical consultations, continuing education, and in-service training for professional and para-professional members of the health care team. Therefore, many video-mediated networks are established as the result of a consortium of users from the public and private sectors joining forces.

Other disadvantages associated with videoconferencing focus upon delays in the transmission of sounds and images which can often result in a blurring of images when rapid movements occurs (Weber & Lawlor, 1998). Another aspect which can compound transmission delays is associated with the addition of multiple sites to a bridge. With multiple sites connected for a multipoint videoconference a slower response time often ensues resulting in an even greater time lag between asking a question and receiving a response (Haynes, 1998). It is possible to overcome some of the disadvantages associated with transmission delay by increasing bandwidth, resulting in the reduction of the delay and an increase in resolution (Fairbanks & Viens, 1995; Savela et al., 1996). Occasionally, technical problems and difficulties in hearing questions from distant sites can disrupt the attention of learners (Byers et al., 1996).

In Bergvik & Gammon's (1997) study of videoconferencing for continuing education, technical problems were often associated with connecting particular sites. Participants often reported sound drop-outs, resulting in the need for the instructors and participants to frequently repeat what was said. Low video quality and small monitor size was also reported to cause difficulties in perceiving non-verbal communication, especially facial expressions. Learners also reported the perception of becoming a "passive learner" when they assumed the role of a listener versus an active participant. As well, Dawes (1998) noted that some learners reported that they experienced extreme discomfort due to the lack of classroom structure, decreased peer interaction, isolation, and feelings of alienation associated with videoconferencing.

The nature of interaction in a videoconference is largely dependent on the instructor and the learning methods he/she employs. It is not uncommon for students to ask few questions and to make minimal use of the interactive potential of videoconferencing. Fisch & Dwyer (1972) found that one-way audiovisual transmission by means of videotape or broadcast television improved the learning situation by providing additional visual stimulation for learners. Nevertheless, the passive nature of viewing did leave many of the participants vulnerable to distractions. Lorensen & Schei (1992) also found that half of the students in a videoconferencing classroom were more reserved about asking questions and providing comments than in a normal classroom.

4.9 Organization and Planning

The effective coordination and planning of any form of video broadcasting, whether it be by videoconferencing or broadcast television, is an important component of successful program delivery. Several factors appear critical for the successful use of videoconferencing. Among these are: the inclusion of practical arrangements for scheduling and booking the conferencing locations; technical stability with a low failure frequency; continuous access to technical support personnel; and the number of participants at each site being adapted to the focus of the program and available supervision. In Bergvik & Gammon's (1997) study, the optimal group size at each videoconferencing site was estimated to be around 2 - 4 participants.

Billings et al. (1989) have identified several factors which could influence the success of videoconferencing including: the ability to provide or acquire video support services; the availability of air time; faculty commitment; administrative and financial support. They recommend that providers consider the development of a video conference plan that involves the identification of curriculum implications, determination of a market, establishment of a budget, selection of a program coordinator, development of reception sites, and the selection and preparation of faculty.

According to Fairbanks & Viens (1995) if a provider is considering the establishment of a videoconferencing or video broadcasting network it is important to consider a number of factors relevant to purchasing and installing equipment. First, incorporating flexibility into the delivery system is vital. The type of technology which is initially used for distance education programs may not always be the same modality needed for the next five years. More technology, not less, will be added to the delivery of distance education programs in the future (Sherwood et al., 1994). Start-up costs for a distance learning network will also demand a detailed plan that considers the major portion of the distance education budget for items such as on-campus studio installation, off-campus classroom improvements, equipment leases, and camera operations. The cost of videoconferencing, as an example, includes the cost of lines, installation, and monthly charges for teleconferencing transmission.

Continuing education providers also need to assess the methods of transmission which are available to remote or rural sites. In many remote and rural areas there can be no telecommunications infrastructure capacity for providing the necessary bandwidth for interactive videoconferencing. Fairbanks & Viens (1995) also suggest that providers consider the format for transmission. For example, will transmission be point-to-point or multipoint? If multipoint conferences are being considered a bridge, which the institution can purchase or lease, will be necessary for transmission to multiple sites. If remote sites are located at other institutions, issues surrounding technical support, room costs, monthly charges, equipment preparation, troubleshooting, and room layout and setup are also important cost considerations.

Coordinating the development and delivery of continuing education offerings via distance technology can be a very time consuming and often frustrating process (Weber & Lawlor, 1998). Program planning will almost inevitably involve tasks which have little to do with the use of the technology. Topics will need to be identified and developed, faculty selected, times and locations scheduled, faculty training sessions organized, public relations and marketing personnel supplied with relevant information, the application process for continuing education credit initiated and managed, support and consultation provided to faculty, supplementary educational packets developed and distributed, the necessary evaluation components identified, and an evaluation conducted (Limon et al., 1985; Weber & Lawlor, 1998). Program coordination will also include tasks focusing on interacting with key players such as audiovisual personnel, remote site coordinators, faculty, accrediting bodies, and supervisors.

Limon et al. (1985) suggests that providers consider initiating planning meetings at a very early date. These meetings should also focus upon long-term planning, the protocol for subcontracting network, production and/or support services, the means for projecting costs, and mechanisms for ensuring collaboration among all production team members. In using a satellite broadcast system, Tangalos, McGee & Bigbee (1997) reported that highly trained technical staff were a necessity to support the communication system, particularly as it began to grow. Henderson (1985) recommends that effective collaboration between continuing education project staff and production personnel is a critical element to program success. Nursing telecourses, as an example, have multiple stakeholders (students, faculty, technical personnel, and site coordinators) and collaboration, ongoing communications, operations coordination, and resource development are key to achieving mutual goals between all the players (Billings et al., 1994).

Site Coordinators

Site coordinators play an important role in the successful delivery of any distance learning program. Site coordinators can have a variety of responsibilities including the provision of faculty support and technical suggestions for effective presentations, assisting in the operation of equipment, registering participants, and gathering evaluations (Weber & Lawlor, 1998). Site facilitators can also assist participants to feel comfortable in the studio environment, help them during call-in periods, answer general questions about the content, and distribute educational materials on behalf of continuing education offices (Limon et al., 1985; Henderson, 1985).

In Reiss, Cameon, Matthews & Shenkman's (1996) project, individuals at distant sites were trained as site facilitators and provided significant assistance in marketing and recruiting public health nurses to participate in continuing education programming. Similarly, Hampton et al. (1994) reported that the cooperation of local site coordinators was an essential component of success in the delivery of their videoconferencing programs. The coordinators assisted in promoting the videoconference, scheduling the meeting rooms, copying handouts, and administering tests. Site facilitators at various sites can also provide assistance in coordinating and guiding off-line discussions and learning activities that focus on group work (Ranstrom, 1997; Henderson, 1985). According to Fielding & Dinning (1981) an important factor in the success of their continuing pharmacy education project was the presence of a pharmacist at each site to deal directly with the learners and technical personnel.

Faculty Orientation

According to Ranstrom (1997) ample orientation efforts must be targeted at faculty and students in order to assist them in becoming familiar with the variety of equipment they may need to use. Orientation sessions may be of particular importance for faculty, many of whom may need to alter their teaching styles in order to use the equipment most effectively (Fairbanks & Viens, 1995; Dirksen, 1993). An orientation session can provide faculty with the opportunity to learn new strategies for overcoming the challenges of teaching learners at a distance (Kaufman & Brock, 1998). These orientation sessions can also be used to introduce faculty to new procedures for producing graphics that complement on-air presentations and to the advance timelines for preparing and submitting material for production for their video-mediated presentations (Sherwood et al., 1994; Fielding & Dinning, 1981; Lorensen & Schei, 1992). Due to the nature of video-mediated broadcasts new presenters will almost always require some form of training in how to adapt their audiovisual materials, such as slides and transparencies, for a broadcast medium (Tangalos, 1997).

Several authors have reported the importance and success of faculty orientation. In Weber & Lawlor's (1998) project, faculty, support staff, and administrative personnel participated in a workshop to learn about the new technology. Local workshops were also held to teach each presenter about operating the equipment and to discuss other issues related to program delivery. Clarke & Chen (1991) described an orientation session organized for faculty which included discussions of the potential audio and video transmission problems which could be encountered and included time for faculty to practice using the technology.

4.10 Teaching

Video-mediated instruction, like most other distance learning delivery mediums, requires the modification and adaptation of an instructor's teaching methods and presentation style to the technology being used (Hegge, 1993). As an example, videoconferencing transmissions often result in a short but noticeable delay between the visual and audio communication components. In order to overcome this delay learners and instructors have to adapt their communication by allowing adequate response time between questions and comments (Fairbanks & Viens, 1995). Similarly, videoconferencing, unlike asynchronous broadcast television and video production, is live and potentially interactive. The skills it calls for are those of sound preparation, good presentation and questioning techniques, sound judgment regarding pacing and the introduction of instructional variety, and the effective use of visual aids (Latchem & Rapley, 1992).

Distance learners in remote video-mediated classes can often feel isolated, disconnected, or unreal if they are not actively involved in instruction (Lewis & Levinson, 1990). If they perceive they are receiving less attention or assistance from the instructor they often form negative attitudes toward the learning environment. One of the goals of distance education is to reduce the psychological distance between instructor and learner (and between learners) and a key to doing this is through frequent interaction in a relaxed atmosphere. Educators play a key role in developing and facilitating strategies to bridge the isolation by creating opportunities for learner-to-learner and learner-to-teacher interactions (Haynes, 1998; Sen Cupta et al., 1998).

According to Kaufman & Brock (1998) one of the elements that can be enhanced to foster learning is known as "elaboration". This refers to the participants' need to examine new knowledge and information in an active manner by discussing their ideas and examining them from different perspectives. In videoconferencing, elaboration is accomplished by asking questions throughout the sessions, cycling systematically across all sites, and calling on participants by name. Instructors need to select a potpourri of teaching-learning strategies (discussion, role playing, brainstorming, case studies) instead of relying solely on the lecture (Philips, Hagenbuch & Baldwin, 1992; Billings et al., 1989). Instructional format is very important in video-mediated instruction and interactive discussions which involve small groups of six to eight people are far more successful than larger groups (Sen Cupta et al., 1998). As is common to most adult learning, participants' prior knowledge and experiences should be used in context, and the presenter can introduce cases to enable this. This technique could be facilitated in a large group or in small groups at each site, but participants should be provided with the opportunity to discuss their own cases among themselves, and to exchange opinions with the presenter and other learners.

The nonhumanizing aspects of the videoconference can also be overcome by paying attention to the principles of adult learning (andragogy) and the characteristics of adult learners. Adults learn best in a climate that is informal, collaborative, supportive, when the approach is individualized and they perceive the teacher as tolerant and understanding. Before the videoconference the instructor can send a brief letter to participants to welcome them, and after the videoconference he can facilitate on-site "educational wraparounds", these are discussion groups which are conducted to help participants integrate what they have learned into their professional practice. Apart from instructors having to be well prepared, Fry, Baer & Cornett (1976) believe that instructors can also play a large role in assisting adult learners to prepare for the distance learning experience. Worksheets can be forwarded to learners to help them in preparing for the discussion in subsequent sessions, reading materials can be preassigned, pretesting can occur, discussion topics can be assigned to various students which they can be asked to discuss, and learners can be presented with the learning objectives for videoconference sessions.

Ranstrom (1997) recommends that nurse educators who teach via interactive television need to be skilled teachers who demonstrate self-confidence, an understanding of the uniqueness of their rural nurse colleagues, and flexibility. Facilitating interaction in a distance learning environment requires both preparation and the use of instructional techniques which draw learners into the group process. Other areas in which instructors need to pay attention focus upon their actual presentation skills and abilities. Presenters should always try to look at the camera to maintain eye contact with the learners, speak clearly, and to keep the participants in sight. Dress and clothing are important considerations as well for this medium and instructors should avoid stark black or white, plaids, stripes or busy patterns. It is recommended that a solid deep colour such as royal blue be worn. Instructors should avoid wearing glittery jewellery which can be very distracting to a viewer. A relaxed posture is essential and sudden erratic movements, paper shuffling, rattling pocket change and annoying mannerisms should be avoided (Weber & Lawlor, 1998; Ranstrom, 1997).

4.11 Instructional Materials

Attention to instructional media is a critical consideration when teaching via video-mediated technologies. Overheads, slides, posters and any other media which are to be displayed to learners require careful design. Special consideration needs to be given to font size, word and sentence length, colours, layout, and the positioning of the camera in relationship to the materials being displayed (Dirksen, 1993; Kaufman & Brock, 1998). Letters should be large, only seven lines per overheard should be used, and graphics should be clearly drawn and shown. Twenty overheads is a realistic amount for the content that adult learners can absorb through visuals in a one-hour class. Three-dimensional models, charts, graphics in textbooks, and newspapers can also be projected by an overhead camera for video-mediated broadcasts. Whatever the material or object to be displayed or televised, the presenter and producer must pay attention to the orientation of the camera and the quality of the material to be presented.

Weber & Lawlor (1998) suggest that faculty be encouraged to present their instructional material as they would in a traditional classroom, with obvious attention given to the preparation of camera-ready visuals to augment their audio presentations. Presenters should also be encouraged to develop educational packets for participants which can include content outlines, bibliographic references, resource materials, and evaluation forms (Millonig, 1988). The preparation and planning time for television production is much more extensive than the time required for traditional classroom instruction. Scripts may need to be produced, not just for the faculty but for the producer, director, and television crew. The instructor and production team must therefore allow adequate time for planning and preparation for the broadcast.

5.0 Computer-Mediated Learning

In recent years, the landscape of the distance education field has been transformed. Significant advances in information and communication technology have enabled the rapid movement of information to almost anywhere in the world. Computer capacities and speeds have advanced to levels previously unimaginable, and present day innovations in multimedia and data compression capabilities are enabling the integration of voice, data, and images over computer networks. Delivery systems that use fibre optics or regular telephone lines are also making use of advanced telecommunication technologies (e.g., Integrated Services Digital Network) and these are revolutionizing the technologies used for delivering distance education programming.

The increased capacities of these information and communication technologies have also contributed to a movement away from traditional continuing education in the health professions. Health care professionals who have installed computers in their offices can access a variety of distant databases. In some areas, electronic consultation networks have developed using e-mail technology and medical information systems which provide the rural physician and other health professionals with rapid access to assisted literature searches and other information sources. As well, direct telephone or even video consultations are rapidly evolving and shrinking the rural health professional isolation problem (Kantrowitz et al., 1979; Verby & Feldman, 1983; Money, 1986; Moore and Hartman, 1992; Puskin, 1992). Telemedicine, using a combination of computer, multimedia and telecommunications technology is expanding throughout the world. According to Moore and colleagues (1994):

> "We believe that the forces that are currently changing health care........will shortly provide opportunities to create a new CME, one that will be more accessible, more convenient, and more relevant. This will be the new paradigm for CME." (Moore et al., 1994, p.11)

Personal computers offer rural and remote physicians many opportunities to utilize electronic databases and networks from their homes or offices without expensive travel to distant CME courses, and without loss of practice time. According to Manning and Petit (1987) computer and telecommunication technologies will open the door for new approaches to medical practice re-certification methods, better access to clinical information, enhanced communication among physicians, and greater access to electronic medical databases. Computer-mediated instruction is one form of distance learning that has the potential to: bridge and reduce the isolation of rural practice; enhance and increase the knowledge, skills, competencies and comfort of those practicing in rural areas; augment both recruitment and retention efforts of rural physicians, nurses, and pharmacists; and, influence the quality of health care provided in rural and remote areas.

The terminology which is often used to refer to computer-mediated learning varies. Computer assisted learning (CAL) or instruction (CAI) can be defined as any learning that is mediated by a computer and which requires no direct interaction between the user and a human instructor in order to run (Nerlich, 1995). CAL is becoming an increasingly common method of enhancing nursing and medical education due to its ability to simulate clinical conditions and its versatility in providing a self-directed educational resource with around the clock access. Computer applications in distance education may also be referred to as computer-managed instruction (CMI), computer-based training (CBT), and in recent times new media learning (NML). Several examples of the newer and more common computer-mediated instructional technologies for distance education include: electronic mail; synchronous and asynchronous computer mediated communication applications; distributed materials on the World Wide Web; and interactive multimedia applications on CD-ROMs (Compact Disk Read-Only Memory).

The interactive nature and capabilities of computers enables the use of several types of instructional techniques or strategies. Schmaus (1991) defines several of the main strategies for structuring computer-mediated learning materials.

Tutorials: presents information or demonstrates skills. Information is presented via text, graphics, sound or a combination of the three. The user is guided through a series of examples to reinforce skills or information.

Drill and practice programs: computerized flash cards help the learner to memorize data or practice applying data. They present questions or problems repeatedly until the student answers or solves them at a predetermined level of proficiency.

Simulations: presents a model of a real-life situation. The student learns by performing the new skills in a realistic context. The learner requests information and then chooses an action. The computer then provides a reaction along with information on the effects that the learner's action would have had in the real world. Based on the information provided, the learner takes more actions and obtains more information.

Games: can be used alone or with tutorials. The computer provides the learner with a set of rules and the learner must solve a problem using the rules, information and clues. Computer games involve competition as a team member, or individually against time or the computer.

5.1 The New Computer-Mediated Learning Technologies

The first experiments with CAI in medical education began in the 1960s at Ohio State University where computers were used as instructional tools for simulating patient encounters (Piemme, 1988). Since these early studies, CAI has grown and proliferated among medical schools and other colleges of health professional education. In the United States, the Association of American Medical Colleges has recommended the production and use of educational software in the medical curricula (Stocking and Benjamin, 1995). As well, many industry experts and developers have designed integrated CAI programming systems. These systems may be used as office and patient management automation tools, extracting necessary information to assist the physician in tracking performance patterns and formulating areas for future computer-based learning (Shortcliffe, 1983; Storey, 1983; McDonald, 1983).

Several studies have documented the development and use of CAI and clinical decision support systems as health professional education tools (Scott, 1994; Locke and Rezza, 1996; Rosenblatt, 1984; Ganiats and Groveman, 1986). The results of these investigations suggest that CAI is used most effective for simulating virtual clinical encounters, in which the computer actually replicates patient cases and encourages the user to choose among a series of diagnostic and therapeutic choices. Participants in these forms of CAI find the computer simulations challenging, instructive, and fun (Locke and Rezza, 1996; Rosenblatt, 1984). In one study, Locke and Rezza (1996) reported the use of computers for enhancing clinical decision making and improving diagnosis by acting as a clinical decision support system (Locke and Rezza, 1996). The physician was required to manage a virtual patient by utilizing current knowledge and electronic clinical guidelines as an educational adjunct to assist them throughout the process of diagnosis and treatment. The authors reported that physicians' reactions to the computer based training application were positive and that physicians were satisfied with the method, and the use of interactive multimedia.

There are several storage systems or electronic information transmission networks that, in recent years, have evolved as effective means for presenting continuing education materials at a distance. Several of the more popular technologies which will be discussed in the following sections include Compact Disc Read Only Memory (CD-ROM), Interactive Videodisc (IVD), and the Internet/World Wide Web.

5.2 CD-ROM

The CD-ROM disc is a small, plastic optical disc which is read by a laser-based disk drive. Rosser (1996) describes the CD-ROM as a low-cost storage media that can contain text, digital audio, digital video, animation and graphics and can be accessed to reproduce information via a computer's monitor and/or speakers in a variety of instructional formats. Each 4.72-inch disc can store approximately 650 megabytes (MB) of digital data. Wimer (1995) states that the characteristics of a CD-ROM, such as its large storage capacity, affordability, availability and multimedia capabilities make it a desirable medium for delivering continuing education. Alves (1995) reported on a study in which physicians, who received a CD-ROM and an accompanying survey in the mail, overwhelmingly indicated (100% of responders) that CD-ROM was an appropriate way for them to earn continuing medical education credit. The common methods for producing interactive CD-ROM courseware are by way of multimedia authoring software applications. Many of these are available for purchase from computer software outlets.

5.3 Interactive Videodisc Systems

Interactive videodiscs are optical discs that use computer and laser technology to store information and create a highly interactive and engaging medium which is fun to use (McAlindon & Smith, 1994; Nierenberg, 1987). They combine the storage capacity and random access capabilities of the computer with the dramatic possibilities of video, slides, photographs, data screens, computer graphics and animation with a very high quality of reproduction. Each side of 12-inch laser videodisc can hold 54,000 still images, 30 minutes of full-motion video, and two 30-minute sound tracks. The laser beams that read this information and translate it into visual images can rapidly access any individual frame (Allan, 1986). The components of interactive videodisc systems usually include a personal computer, a monitor, a videodisc player, and an interface device which enables the computer to drive the videodisc player.

Interactive videodisc (IVD) technology enhances the learning experience by enabling the learner to control the pace and sequence of content presentation, providing an active rather than passive experience. IVD can also be programmed to provide immediate feedback to a learner's response. Together, these elements are found to result in a reduction in the time required to present lesson content, an increase in learner retention, and a decrease in the time for learners to learn new information.

An IVD system operates by storing information in a constant linear velocity

(CLV) versus a constant angular velocity (CAV) format. In a CAV format, frames are placed in one long spiral emanating from the center of the disc. This prohibits the display of specific frames by location. In constant linear velocity (CLV) the videodisc is repurposed and frames are stored in concentric circles allowing random access to information stored on the disc.

In Umlauf's (1990) study a computer-assisted instructional (CAI) program was combined with an interactive videodisc program that would certify learners in CPR. In order to become certified, the learner needed to view the interactive videodisc program, pass written tests, and pass the CPR performance test with a computer-simulated mannikin. The learning system's mannikin was equipped with sensors that detected and measured multiple factors, such as the volume and degree of air pressure during ventilation, degree of neck extension for opening the airway, and hand position during compression. The simulator could observe, time, measure, and evaluate every facet of CPR performance simultaneously and at a consistently high level.

Folberg et al. (1993) also described a computer-based IVD program which provided the following features to users: (1) rapid access to thousands of high-quality illustrations with the option of superimposing graphic labels and text directly over pictures; (2) the ability to view enlargements of photographs; (3) an online glossary to view definitions of terms coupled with high-quality photographs; and (4) a dynamic introduction to pathophysiology using interactive animation sequences. A majority of participants indicated that they preferred the medium of interactive education to textbooks (62%), videotapes (68%), and lectures (72%).

Parker (1984) describes the implementation of an interactive videodisc learning system for nurses. The system involved a microcomputer interfaced with a videodisc player which allowed nurses the convenience of selecting what and when they wanted to learn in the hospital environment. Masse-Holbert and Sudia-Robinson (1992) explain that the interactive videodisc has the ability to present live-action scenes of nurses and other health care providers interacting with patients. Nurses can then be queried on the appropriate actions to care for the patient and based on their response, provided with another sequence which demonstrates the consequence of their choice. This develops and enhances cognitive decision-making, problem-solving, and critical thinking skills in the learner.

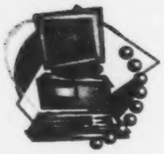
5.4 Internet and the World Wide Web

In recent times the growth of the Internet and the World Wide Web have created new opportunities for providing distance education. Proponents of the Internet suggest that it will have far greater impact on global communications than any other previous communication technology development. Doyle (1996) predicts greater Internet developments in the future which will include continued improvements in speed of Internet access as ISDN (Integrated Services Digital Network) line developments increase the potential for downloading large files, such as real-time video. As well, new Web browsers have enabled the transmission of encrypted information to enhance security. This enhanced security has important implications for the storage and transmission of medical related patient information. Further, advocates of online continuing education for the health professions suggest that in the future, more and more courses will be delivered through the World Wide Web (WWW) by accredited continuing education Web Service providers. Health professionals will be able to pay for continuing education services using digital cash or credit cards, and submit online evaluations using CGI Web page forms.

McEnery (1995) defines the Internet as an international network of computer networks that uses standardized protocols for the exchange of information. It was originally developed during the late 1960s as a robust computer network for the US military and research institutions. At that time it was only accessible to those knowledgeable of computer command language and was limited in operation due to computer platform incompatibility and a form of data retrieval which occurred through linear information paths. In the 1980s Tim Berners-Lee, a physicist at the European Laboratory for Particle Physics in Geneva, developed hypertext to overcome these problems. Hypertext enabled an interconnected web of information nodes to be hyperlinked together rather than in a hierarchal tree. This hypertext program, the "World Wide Web" (WWW, Web, W3) was launched in December of 1990.

The National Science Foundation (NSF) supported the development of the Internet through the design of a graphical user interface (GUI) for a Web browser at the National Center for Supercomputing Applications (NCSA), University of Illinois. In February of 1993, NCSA's Mosaic became the first graphical WWW browser. Web browsers (today's Netscape Navigator and Internet Explorer) read Hyper Text Markup Language (HTML) and use the "http://" addressing scheme to allow users to travel over the Internet to a Web site, where one can navigate their way through various pages of information. The World Wide Web enables the use of multimedia for the presentation and representation of information. Multimedia refers to an information environment that uses computers to integrate text, graphics, images, video, and audio (Galbraith, 1992; Tolhurst, 1995; Shih and Alessi, 1996; Najjar, 1996).

The Internet allows users to interactively take tests, search databases and communicate, all of which make it particularly suitable for remote education (Eager, 1997). Eager (1997) has noted that online CME courseware written by medical



experts provides a convenient method for evaluating and enhancing learners' skills and knowledge. Several computer mediated communication (CMC) services are available through the Internet and have become very important tools in the continuing education of health professionals:

E-mail: allows individuals to send and receive messages / text to and from others via the computer (Hayden, 1997);

Internet teleconferencing: software which allows participants to hold "virtual meetings" in which participants around the world, can participate as if they were in the same room (Ruskin, Palmer, Hagenouw, Lack & Dunninn, 1998);

Listservs: electronic discussion groups which permit free registration and enable participants to receive and respond to information via e-mail. Information is sent out to all registered members (Hayden, 1997);

Internet Relay Chat: allows one participant to type information on his/her keyboard which is immediately transmitted to other computers around the world ("Isues in," 1997). In this system many users are able to converse using the same channels (Pease, 1997).

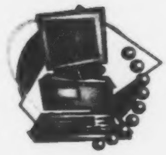
Other computer-mediated communication systems are also being used for continuing education, as means of disseminating course material or for student support services. The electronic bulletin board system is a computerized communication system which requires a computer, a modem and communications software. Participants in this type of system have access to e-mail, library files for downloading, online database retrieval and are able to interact with other users (Russin & Davis, 1990). Russin and Davis (1990) conducted a feasibility study of the use of the electronic bulletin board system for the continuing education of Florida's nurses. These systems were found to be very efficient for providing online continuing education. As a result, a significant number of Florida's schools and colleges, who offer continuing education programs to nurses, have indicated an interest in using a bulletin board system to offer CML.

Computer mediated conferencing is a computer messaging system which merges telecommunications and computers to allow geographically dispersed groups of people to communicate with one another by way of text-based messages (Tagg and Dickinson, 1995; Berge, 1996; Murray, 1997; Landis & Wainwright, 1996; D'Allesandro, Ackerman & Sparks, 1993; Garner, 1998; Ostbye, 1989; Cragg, 1994). It does not include various types of real-time, or synchronous communications such as chat rooms, voice-based teleconferencing or video conferencing. Participants use personal computers, a modem and Internet connection, and a WWW browser to communicate with a central host computer server running a computer conferencing software. They can call the host computer 24 hours a day, read comments left by their colleagues, and leave messages for other learners. More than one person can be connected with the host computer at a given time, but the ususal experience is asynchronous, that is the interactions occur independent of time and place. One participant may respond to a question posed by another several minutes or days later. The choice of when to contribute to the discussion is at the sole discretion of the participants.

Computer conferencing, and computer-mediated communications in general, transform the traditional classroom communication model of one-to-one or one-to-many interactions. They enable a discourse which is based on many-to-many interactions, including learner-to-learner and learner-to-instructor. Ruberg et al. (1996) have reported significant benefits of the increased peer interaction and collaboration resulting from computer conferencing. According to these authors, these benefits are well documented in both cooperative learning research and in constructivist theories of learning: students are forced to confront each other's ideas; students can enact complementary roles, provide mutual guidance and support, and can serve as scaffolding to help each other accomplish learning tasks that might otherwise be too difficult; students can find a direct relationship with a real audience from which they can get meaningful feedback; students can experience and construct new understandings and ideas in a peer discourse setting (Ruberg et al., 1996, p. 245).

The World Wide Web, the fundamental content delivery mechanism of the Internet, is the front-end application that has stimulated the enormous growth of the Internet. A World Wide Web site contains pages or documents. Web documents or pages are what is displayed by a Web browser. What is displayed is determined by an ASCII text file containing HTML codes called tags. These tags specify how text in the file is to be displayed, and can call for the contents of certain other types of files to be automatically displayed at specific spots in the document. These other files may include graphics or other specialized media files containing sound, animation, and film clips. Web pages contain many things not offered by the printed page. They offer entry fields (into which visitors can enter information); animation, video, and audio; buttons (hypermedia graphics linked to certain functions); and hypertext (colored or highlighted text that links the visitor to another section of the Website).

The core of hyperlinking and navigating World Wide Web documents is hypermedia. According to Yang and Moore (1995) hypermedia has two fundamental characteristics. One of these characteristics is hypermedia's non-linear association of information. Informational segments in the hypermedia environment are represented in chunks or nodes which a learner has the ability to navigate through by following



paths or links that appear relevant (Tolhurst, 1995). This non-linear association encourages active individualized learning. The second characteristic of hypermedia is that it is represented and managed around a network of multiple information or multimedia formats. Text, charts, graphics, animation, video and sound are all possible in hypermedia systems. The use of these multi-format knowledge bases has several potential benefits:

> 1) Providing rich and realistic contexts for multichannel learning. A hypermedia system can present vivid information in various formats.
>
> 2) Accessing information non-linearly. Allows learners to access and explore information based on their needs, interests, or whims.
>
> 3) Focuses learners on the relationship of facts. The structure of hypermedia helps learners focus their attention on learning relationships among facts.
>
> 4) Encouraging active, student-centered learning. A hypermedia system is an interactive environment. Learners control learning speed, amount, and path based on their abilities and needs. (Yang and Moore, 1995, p. 5)

The WWW has been found to be a very helpful tool for assisting the health care provider in staying abreast of new clinical developments, communicating with colleagues, and accessing remote databases (Meissner and Vujicic, 1995). In the United States, CME is being delivered through the WWW by several university-based clinical divisions and CME offices. At the University of Tennessee Medical Center, physicians can complete certifying examinations in fluoroscopy procedures placed on the WWW (Thompson et al., 1996). Physicians have expressed widespread satisfaction with the certification process, reporting ease of access and confidentiality.

At Marshall University's School of Medicine, a CME Web-based course has been developed to improve physicians' clinical and history taking skills, and is accredited for one hour of CME credit (Hayes and Lehman, 1996). The system simulates an actual patient encounter, with the learner playing the part of examining physician and the program acting as patient. Pictures of the patient serve as image maps to which the user can point and click, and inspect more closely. Lab and radiologic studies can be requested and the learner can submit a diagnostic and treatment for evaluation and CME credit. The authors indicate that responses to this form of "virtual" CME have been very positive (Hayes and Lehman, 1996), however they do not provide any evaluative information on how effective the program has been in producing knowledge gain, enhancing behavior, or how future programs could be improved.

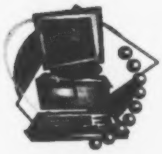
In another example, the University of Iowa College of Medicine has developed an online "Virtual Hospital" (Galvin et al., 1994). This WWW program includes multimedia teaching files, current diagnostic and therapeutic algorithms, patient simulations, historical information, patient instructional data, and online CME materials (Galvin et al., 1994). Response to the Virtual Hospital has been positive and new information is being added to the site every day. Similarly, an interactive educational multimedia program developed at the John Hopkins Medical Institute has been used to teach physicians about the role of computed tomography in detection and evaluation of splenic disease (Calhoun and Fishman, 1994). The program includes four sections: lectures with images, text and audio; a text section patterned on a journal article with an index categorized by pathologic process; a quiz with links to relevant text sections; and teaching files with selected patient histories and diagnoses (Calhoun and Fishman, 1994).

5.5 Advantages of Computer Assisted Learning and Instruction

Storage Capacity and Rapid Access to Information

One of the greatest advantages of computer assisted learning is the relative ease by which an individual can access enormous amounts of information (Manning & Petit, 1987; Klatt & Dennis, 1998; Burnham, 1996; Gallagher & McFarland, 1996). The computer can store and retrieve large amounts of information in seconds (Piemme, 1988). CD-ROM programs offer the advantage of being able to search several volumes, append existing notes, print specific portions and to easily transport very large amounts of information (Jewett, Holsinger, Kuppersmith & Buenting, 1998). The computer also has the ability to repeatedly perform repetitive teaching tasks without tiring (Heinrich, Fichandler & Cuono, 1988; Reed, Collart & Ertel, 1972).

In addition to the vast amounts of information now available on the Internet, computers permit much quicker access to, transmission, and/or the revision of publication materials (Veldenz & Dennis, 1998; Sikorski & Peters, 1998; Leow, 1996). Ruskin, Doyle and Engel (1996) state that electronic publications which use multimedia components, such as sound and movies, are able to present health science information in a way that would almost be impossible in printed text. Computer-assisted learning can also allow the learner to have quick and easy access to



bibliographic and other reference materials (Ward, 1997; Huntley, 1998; Smith, 1997; LaRocque, 1998; Storey, 1986; Robertson, 1994; Burnham, 1996). Health professionals are now able to search medical databases such as MEDLINE and CINAHL directly from the home or office using a PC.

Increase in Health Professionals' Computer Access

An important access issue for using computers in continuing education is the availability of both hardware and software components to the learner. Hoffer (1989) reports that computer-mediated learning became practical with the widespread availability of personal computers and the ease of dialing into a central computer via standard telephone lines with a modem. Using computers to obtain continuing health education credits is becoming very real and feasible as accessibility to computer-mediated learning is increasing (Held & Kappelman, 1976). In a study of physicians practicing in Texas, Kripalani et al. (1997) found that 78.4% of respondents reported having previously used a computer and 48.5% indicated they would be interested in computer-assisted continuing medical education (CACME) if they could use a computer that they already had access too. Almost one-third (31.3%) of the responding physicians stated that they would be willing to invest in a computer or computer upgrade in order to participate in CME courses.

Place and Time Independence

Another benefit in incorporating computers into the continuing education process is the transmission of information directly to the learner wherever he/she chooses to learn (Caldwell, 1981; Kilmon, 1996). Professionals can now receive training in the work environment (Parker, 1984), which means they do not have to shut down their practice or obtain time off in order to attend (Jewett, Holsinger, Kuppersmith & Buenting, 1998; Bolwell, 1989). Computers can allow the provision of pertinent information at the time and place where patient care takes place (Piemme, 1988; D'Alessandro et al., 1996; McDonald, 1983). Ostbye (1989) describes the use of computer mediated conferencing in the teaching of epidemiology and medical statistics. The results of an attitudinal survey of learners indicated that location and time independence (being able to log on and participate from wherever and whenever it suited them best) were two of the greatest advantages of the system. CML can be made available 24 hours a day, seven days a week (Klatt & Dennis, 1998; Nerlich, 1995; Heinrich, 1988; Pankaskie & Sullivan, 1998; Schmaus, 1991; Keckan, 1997; Hayes & Lehmann, 1996). This unlimited access to learning materials, regardless of time and location, has been reported many times in the literature as one of the main advantages of computer-mediated learning (Ward, 1997; Billings, 1986; Lancaster & Willis 1994; Eager, 1997; Bergeron, 1998; Treistman, Watson & Fullerton, 1996; Masten & Conover, 1990; Hayes & Lehmann, 1996;

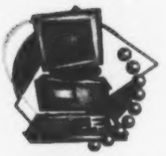
Glover & Kruse, 1995; Petlin, 1994).

Benefits for Faculty

Computer-mediated learning also has several benefits for faculty, staff, and instructors in schools of health professional education. The use of CAL by a professional training institution means that faculty members can contribute to course curriculum without being restricted by time and place (Masys, 1998). By utilizing computers in the continuing education of staff members, training courses can be efficiently offered to one member at a time (Davis, 1998) or to very large groups (Treistman, Watson & Fullerton, 1996). Educators are also freed of the more tedious tasks of administering and scoring tests, and the record-keeping associated with monitoring attendance at traditional staff development programs (Billings, 1986).

Some studies have also reported that time can be saved in developing and presenting instruction (Billings, 1986; Lancaster & Willis, 1994; Schmaus, 1991; Hannah et al., 1989). Once the program is designed or bought, it can then be used by all nurses, on all shifts, thus reducing teaching time (Billings, 1986). Learners are also able to save time by controlling the pace of instruction, taking tests to determine when and if review is necessary, and proceeding on to the next section without having to wait for another teaching session to begin (Billings, 1986). In a survey to determine the effectiveness and efficiency of a CAI program that facilitated instruction on a nursing unit during work hours, Criddle (1995) reported a significant time and cost savings for the institution in terms of reduced instructional time.

Several other benefits are provided to the educator who uses computer-assisted learning. Buchholz (1979) reports that computer-assisted instruction allows the educator to become a helper, facilitator, consultant, guide, and resource person and not merely a transmitter of knowledge. This type of instruction relieves the educator of repetitive teaching tasks, thus freeing up more time for focussing on individual learner needs (Ferrance-Porter, 1978) or for clinical or skill issues (Reed , Collart & Ertel, 1972). CAI also allows the advantage of automated record keeping in terms of student progress and use (Lancaster & Willis 1994; Masten & Conover 1990; Buchholz 1979; Ferrance-Porter 1978; Reed Collart & Ertel 1972). Incorporating computer-assisted instruction into teaching can also improve teaching ability (Buchholz, 1979). This type of instruction requires faculty to engage in the development of a logical sequencing structure for their learning material. This results in an enhancement of the educator's ability to analyze the material and to more effectively plan and present instruction.



Interactive Learning

One of the more common advantages of computer-mediated learning relates to the computer's ability to facilitate interactive learning through active learner participation (Howard, 1987; Horn et al., 1997; Richardson & Norris, 1997; Eager, 1997; Daly, Nicholls, Brain, Grassby & Temple, 1990; Adsit, 1996; Schmaus, 1991; Ostbye, 1989; Masys, 1998; Heinrich, Fichandler & Cuono, 1988; Hodson-Carlton, Ryan & Siktberg, 1998; Masten & Conover, 1990; Pogue, 1982; Hannah et al., 1989; Buchholz, 1979; Ferrance-Porter, 1978). Research findings have suggested that interactive learning programs can be programmed to require learners to answer questions in order to advance through a program. Because of this, attention levels are found to be higher and maintained longer, resulting in a greater likelihood that learning will occur and be sustained (Lancaster and Willis, 1994). In a study carried out by Neafsey (1997), participants cited interactive question sequences and techniques as one of the major advantages of a computer-mediated learning program.

Self-paced Learning

Another common advantage of CAL cited in the literature is the application of self-paced learning (Howard, 1987; Lancaster & Willis, 1994; Adsit, 1996; Masys, 1998; Keckan, 1997; Heinrich, Fichandler, & Cuono, 1988; Masten & Conover, 1990; Hayes & Lehmann, 1996; Schramm and Gollnick, 1998; Pogue, 1982; Laberge, Marton & Racicot, 1997; Hannah et al., 1989; Petlin, 1994). Learners are free to read, review, and repeat any component of the program as often as necessary (Neafsey, 1997, 1998a; Kilmon, 1996; Schmaus, 1991). Learners are also able to start, stop, and begin a program immediately where they left off (Reed, Collart & Ertel, 1972; Buchholz, 1979; Davis, 1998).

Individualized Instruction

Individualized instruction occurs when a program is capable of being tailored to meet the learning needs of an individual participant or those of an organization (Sheridan & Legros, 1995). CML programs can be designed so that those who understand introductory levels of content and are able pass a pretest can proceed to more complex instruction, while those who require extra information can request as much supplementary instruction as needed (Billings, 1986; Parker, 1984; Leveridge, 1983; Hannah et al., 1989; Ferrance-Porter, 1978,). This process is often referred to as "adaptive learning," that is the computer is able to respond appropriately to the knowledge demonstrated by the user (Daly, Nicholls, Brain, Grassby & Temple, 1990; Pogue,1982). As an example, a correct answer by a participant results in advancement through the program, whereas an incorrect answer by the participant results in a review of the material in question until the learner can correctly respond.

The notion of "tailoring" can also occur through the testing or assessment process (Piemme, 1988). In "adaptive testing," the test taker is asked a question of known difficulty by the computer, which if answered correctly allows the user to move on to a more difficult question. If the question is answered incorrectly, the computer responds with an easier question resulting in a process in which the difficulty and type of question presented to the learner is a function of the previous one. Many reports in the literature have indicated that individualized instruction is a major benefit of computer-assisted instruction (Howard, 1987; Lancaster & Willis, 1994; Adsit, 1996; Masten & Conover, 1990; Buchholz, 1979; Reed, Collart & Ertel, 1972).

Another example of the computer's ability to individualize the learning process focuses upon learning styles. Messmer, Kurtyka and Kelley (1992) discuss the use of learning theories in the development of computer-based training programs. The authors conclude that computer-assisted learning allows the development of programs which can adjust to the variety of learning styles normally present in any group of learners. Therefore, participants who prefer to learn through watching or thinking can be accommodated just as well as someone who prefers to learn by doing (Eager, 1997).

Learner Control

Individualized learning can also be accommodated by structuring programs in a manner which enables self-directed exploration. The World Wide Web incorporates the use of hypertext and hypermedia, that is each information node (pages or multimedia) are linked or branched to many others. Individuals use links (hypertext or hypermedia) to make choices about which nodes in a knowledge base to browse and learn from. A hypertext system allows an individual to acquire more information on a word or concept that needs to be further explored (Chen, 1989). This unique and empowering aspect of hypermedia systems means that learners are provided with greater opportunities for increasing their control over depth of study, range of content covered, number and type of alternative media selected for presentation, and time spent on learning. The hypertext capability of the WWW also allows documents to be cross referenced based on their categorization into various topics (Alusi, Tan, Campos, Linney & Wright, 1997).

Learner control in a hypermedia instructional context allows students to tailor their instructional experiences to suit personal and professional needs and interests. Adult learners appear to prefer learner-controlled instructional materials. Learner control has been linked to a variety of favorable affective outcomes, such as increased levels of engagement, more positive attitudes, and decreased anxiety (Kinzie and Berdel, 1990). Many cognitive theorists contend that learners who are

afforded the opportunity to direct their own learning can process information more deeply, and as such, obtain a better command of the information (Lawless and Brown, 1997).

Multimedia

Computer-based educational applications have the advantage of being able to display dynamic sequences and reproduce a variety of images, a distinct advantage over other types of instruction (Schramm & Gollnick, 1998). The use of graphs, statistics, maps and user-friendly presentations make for an interesting and attractive form of continuing education (Millership, 1988; Cuevas, Moody, MacFarlane, Rada & Ghaoui, 1993). The World Wide Web also offers multimedia capabilities making it an invaluable teaching resource for visual disciplines such as histology, pathology, surgery and anatomy by enabling the storage and display of large numbers of images and text (Alusi, Tan, Campos, Linney & Wright, 1997; Masys, 1998).

According to dual coding theory (Paivo, 1971, 1986, 1991; Clark and Paivo, 1991) information is processed through one of two generally independent channels. One channel processes verbal information such as text or audio. The other channel processes nonverbal images such as illustrations and sounds in the environment. Information processed through both channels is called referential processing and has an additive effect on recall. Learning is better when information is referentially processed through two channels than when the information is processed through only one channel. Computer-based multimedia instruction tends to be highly interactive which appears to have a strong positive effect on learning. Najjar's (1996) examination of 75 learning studies indicated that people learn material faster and have better attitudes toward learning when they learn in an interactive instructional environment.

Lawless and Brown (1997) have identified multimedia as a useful system for facilitating problem-based or case-based learning activities. Multimedia enables the representation of salient visual, auditory, and nonverbal cues using a variety of multiple information modalities. The representational richness of multimedia can assist learners in comprehending the situation and observing the relevance of various contextual elements. This simulates the real world more realistically than text-based cases and elicits meta-cognitive problem-solving skills needed to situate learning and the content of the courseware within the clinical practices of the health care provider. According to Jonassen (1995) computer-mediated learning technologies should be used to contextualize learning, to situate learning in a meaningful real-world task, simulated through a case-based or problem-based model.

Learner Feedback

Several studies have reported that an additional advantage of computer-assisted instruction is that it provides immediate feedback to the adult learner (Neafsey, 1997, 1998a; Hulsman, Ros, Janssen & Winnubst, 1997). Lancaster and Willis (1994) found that programs which offered instantaneous feedback to a learner's response motivated that individual by providing positive ongoing reinforcement for the learning effort. The benefit of reinforcement in the learning process was also cited as an important feature of CML by Keisch, Fox, Grigsby and Perez (1992) and Masten and Conover (1990). In a study designed to investigate the benefits of using CML on a nursing unit during regular work hours, Criddle (1995) reported that 95% of all respondents indicated that the feedback provided by the program assisted their learning process. Pengov, Wright and Forman (1979) found that physicians and residents participating in a CAI module in family medicine topics rated the appropriateness of the CAI feedback as "Excellent" or "Good".

User-friendly and Personal

Participants in several studies have reported that computer-assisted instruction is a "user-friendly" form of continuing education (Mottram, Rowe & Stanley, 1993; Jim, Filibeck, Gee, O'Bey & Fox, 1982; and Jim, Gee, Hyneck et al., 1984). In a study carried out by Neafsey (1997) nurses who completed a home study CAI program reported that the organization and simplicity of the instructional software were two of its main advantages. A computer-assisted learning program also allows the learner a certain level of privacy with their learning and study (Masten & Conover, 1990; and Hannah et al., 1989). Learning can occur in a private and personal setting where participants are relieved of pressure from a large group of peers and instructors (Billings, 1986). Adult learners also have the advantage of being free to choose incorrect options or answers they are unsure of, to see what feedback is provided without feeling embarrassed or intimidated by others (Kilmon, 1996).

Self-assessment

Buchholz (1979) indicates that a further advantage of CAI is the ability to provide learners with access to a larger number of self-assessment options and responses. Computer-mediated learning programs can be programmed in a way that online self-assessments have to be completed throughout a program, following individual lessons or units. Learners can also complete an online evaluation at the end of the program which provides immediate feedback to them on their answers (Eager, 1997) and in some programs learners are also able to receive direct documentation of their participation (Horn et al., 1997). Glover and Kruse (1995) report that a good CAI program is one that is patient and private; it should not "ridicule, scold or judge you."

Problem-oriented Simulations

Case studies and patient management problems are useful learning tools which allow a learner to follow an organized path through a series of problems which can be set in a virtual or simulated health environment (Cuevas, Moody, MacFarlane, Rada & Ghaoui, 1993; Neafsey 1998; Kilmon 1996; Heinrich, Fichandler & Cuono 1988; Keisch, Fox, Grigsby & Perez, 1992; Woodbury, 1984). Neafsey (1997) reported that nurses participating in a home study CML course indicated that case mysteries, animation sequences, and embedded instruction (explanations for incorrect and correct answers) were useful components of the course. In a paper describing the development of an interactive patient program, Hayes and Lehmann (1996) report that combining learning with fun and interactive activities enhances the learning experience and increases the likelihood that physicians will return to the program or site.

Computer applications are also capable of mimicking the actual patient encounter (Kilmon, 1996; Nerlich, 1995; Willy, Sterk, Schwarz & Gerngross, 1998; Lyons, Miller & Milton, 1998; Kizakevich, McCartney, Nissman, Starko & Smith, 1998). Various computer applications, including case studies and simulations, allow learners to practice critical thinking and decision making skills in a "safe environment" without endangering patients (Lancaster & Willis, 1994; Billings, 1986; Schcmaus, 1991; Lee, Ault, Kirk, & Comstock, 1995; Glover & Kruse, 1995; Masse Holbert & Sudia Robinson, 1992). Piemme (1988) reports that simulation programs permit the learner to make errors in reasoning and judgement without penalty to anything but the learner's ego. The learner is able to practice without the anxiety which comes with working with real patients (Kilmon, 1996). Izenberg (1998) describes the application of a CML program which provides a mini-fellowship in treating patients with HIV/AIDS. An advantage of this educational program, as stated by Izenberg, is the ability to learn in an environment which simulates the patient encounter including the emotional impact of various clinical decisions. Computer applications allow educational programs to become patient-oriented rather than subject-oriented (Heinrich, Fichandler & Cuono 1988; McDonald 1983; Storey 1983).

Decision Support Systems

Several types of educational computer programs are also available which provide a variety of practice related services to health professionals. These programs include patient management programs, computer consultant programs, and expert systems. Patient management programs request specific and relevant clinical information on a physician's patient and enable the learner to become better at diagnosing and treating patients (Heinrich, 1988). Piemme (1988) reports that programs designed to advise the physician regarding diagnosis and management may have greater impact because of their educational value. Keisch, Gox, Grigsby and Perez (1992) note that patient management problems provide alternative methods of presenting information and stimulating problem-oriented thought. Consulting systems have the ability to provide up-to-date, factual material about clinical concerns such as probable cause of illness, which drugs to prescribe and which tests to order. They have the capability to offer consulting at the level of an expert diagnostician (McDonald, 1983). Expert systems are similar to consulting programs in that they offer expert advice, from a particular area of study, to the health care provider. Expert systems can provide the line of reasoning used in arriving at a conclusion and can also explain how relevant a particular item is in deriving a conclusion (Saleem & Moses, 1994). Storey (1986) suggests that the benefits of computer-assisted diagnosis and treatment programs are one of the main reasons why physicians should incorporate computers into the daily practice.

Just-in-time Learning

Another aspect of practice-related educational services is the use of Practice Learning, Just-in-Time Learning and the Push Paradigm. Manning and Petit (1987) state that physicians should use practice data in order to identify their current educational needs. Barnes (1998) describes how a practice-learning model for CME using information technology begins with the physician reflecting on his/her own practice in order to determine appropriate learning opportunities. The computer stores relevant information from the physician's practice habits in order to assist with this reflection-on-practice. "Just-in-Time Learning" allows the physician or health care provider to review material for a procedure or patient visit that will occur later on in the day or week (Eager, 1997). With this system the professional can get a quick update or refresher course by filling out an on-screen form on a CME Web site. Bergeron (1998) reports that "Just-in-Time" learning results in minimal interruption or loss in efficiency during work, and the learning process can be repeated when and as often as necessary. "Just-in Time" learning can also take place in the physician's office during the patient encounter. Information can be made available during patient care to answer both patient and physician questions, as well as to permit the incorporation of current scientific evidence (Barnes, 1998).

The "Push Model" brings information directly to the learner's computer so that the professional does not have to spend time searching for appropriate information. The Internet is used to automatically deliver documents directly to a list of course participants (McEnery & Grossman, 1997). The learner is then required to fill out an online form providing answers to questions and appropriate diagnoses. "Just-in Time" systems can also push information into the clinical practice (Barnes, 1998). Electronic prompts and reminders stimulate health care professionals to identify their individual learning needs. Karlsson, Ekdahl, Wigertz and Forsum (1997) carried out an interview study to determine the ways in which clinicians used a computerized decision-support system to access information. They found that the two main uses of the system were to get patient-specific decision-support information and to obtain continuing medical education.

Information Enhancement and Instructional Design

The multimedia applications and the increased access provided by CML offer several information benefits. The two most common benefits reported in the literature are the currency of information and the consistency in content, design and delivery provided by these learning systems. Valdenz and Dennis (1998) state that the currency of the information provided by CML can be revised and updated in a matter of minutes. For instance, Web-based CME material can be constantly reviewed and updated by subject matter experts (Horn et al. 1997; MacFarlane, Cuevas, Moody, Russell & Schlecht, 1996; Thompson, Dyke & Buonocore, 1996; Klatt & Dennis, 1998; Treistman, Watson & Fullerton 1996; Marks-Maran 1998; Glover & Kruse, 1995). Because of this, the adult learners who are downloading educational materials via the Internet can have a greater assurance of accuracy and timeliness; they know the material they are downloading are the most recent (Pankaskie & Sullivan, 1998).

In a study designed to evaluate a home study program for nurses, Neafsey (1997) reported that a strength of computer-assisted instruction was the fact that variables such as content, instructional design and delivery system could be held constant. Courseware which is delivered over a network to many physicians at one time can provide a more common learning experience among a group of learners (Caldwell, 1981). Billings (1986) reports that instructional consistency in both teaching and evaluation is an important advantage of CAI. The learners receive consistent and replicable instruction (Lancaster & Willis, 1994; Schmaus, 1991; MacLeod & Costello, 1994; Keckan, 1997; Masten & Conover, 1990; Glover & Kruse, 1995; Hannah, 1989).

Navigation and user-friendly software interface features are an important part of effective instructional courseware design as well. The navigation features and interface of instructional courseware should be intuitive, implying that learners spend little time learning how to navigate courseware systems, and thereby focus more attention to the content. Yang and Moore (1995) propose that an important aspect of effective instructional courseware interface is its operational features. Operating directions should be clear and specific, and there should be "consistency of operation" throughout instructional programs. Caldwell (1981) has reported that CAI courses often result in more time and effort spent on instructional planning and preparation, given that computer delivery requires explicit statements of objectives and performance points.

Given the currency and quality of information presented in CML courses, additional concerns include the relevance and level of understanding of the course material. In a study by Neafsey (1998) a majority of nurse participants reported that an added advantage of CAI is the ability to make complicated material more understandable. Hulsman, Ros, Janssen and Winnubst (1997) found that medical specialists participating in a CAI course on communication skills in oncology evaluated the course as meaningful and relevant to their daily practice. Mottram, Rowe and Stanley (1993) also reported that 95% of pharmacists evaluating a CAI software program felt that the presented cases were realistic, and a valuable refresher on the points and issues which were raised.

Communication and Support

The benefits of the communication and support that are offered by CML can be divided into two main categories. These are peer support and communication, and educator/tutor support and communication. Peer support and communication can come in many forms including consultation, discussion groups, and collaboration. Goldsmith (1998) reports that online continuing education courses, e-mail access to experts for consultation, clinically specific mailing lists and news groups, and online access to national databases are all powerful tools in keeping nurses up-to-date and current with the latest developments in the field. Goldsmith also notes that one of the greatest benefits of the Internet for nurses is that it offers a forum for collaboration and the exchange of ideas with peers around the world. Several authors have suggested that the peer collaboration facilitated via computer mediated communications networks can extend the professional's knowledge base and improve his/her practice (Garner, 1998; Hekelman, Niles & Brennan, 1994; Gallagher, 1996; Sheridan & LeGros, 1995; Ward, 1997). In one study, physicians contributing electronic text to an online discussion group favoured the 'critical mass' model of continuing education promoted by the technology, in which a relatively small number of members contributed on a regular basis (Roberts & Fox, 1998).

Computers allow physicians to carry on synchronous and asynchronous discussions with physician colleagues (LaRocque, 1998), and foster the development of communication and support networks between learners and educators (Ward, 1997). Health care professionals who participate in news groups are able to interactively discuss current developments and trends (Veldenz & Dennis, 1998).

Providers of CAI programs are also providing a means for learners and tutors to communicate privately. Petzinger-Kaplan, Radonic-Patton and Hamilton (1996) suggest that a successful CML distance learning program should include both a public forum such as conferences where students and tutors interact openly, and a private forum such as e-mail so that the student can communicate privately with the tutor. Learners who can contact tutors without having to speak to them directly via the phone or face-to-face may be less reluctant to ask questions or provide opinions in a face-to-face environment (Murray, 1996).

Cost Savings

An important aspect in the decision to incorporate computers into continuing education is whether or not the process will be cost-efficient. If participation in CML courses is not cost-efficient, individual learners and institutions interested in staff development will simply refuse to participate. The increase in the availability and access to computers over the past decade is playing an important role in maintaining the price of CML at a fairly reasonable level. The costs of computer-based education cannot be calculated entirely on how much it costs to develop instructional materials or the cost of a terminal or microcomputer. The savings that occur as a result of physicians not having to leave their jobs to attend more traditional types of continuing education also have to be calculated (Caldwell, 1981).

The literature provides a great deal of evidence which indicates that CML is a cost-efficient means of providing continuing education (Hekelman, Niles & Brennan, 1994; Pankaskie & Sullivan, 1998; Masten & Conover, 1990; Willy, Sterk, Schwarz & Gerngross, 1998; Petrie & Lippman, 1994; Hannah et al., 1989; Held & Kappelman, 1976; Reed, Collart & Ertel, 1972; Treistman, Watson & Fullerton, 1996). The costs of incorporating CML into an existing continuing education program decrease proportionately with the number of learners that will be using the program -- the more users, the lower the cost. The opposite is true for traditional classroom instruction, in which the costs increase as the numbers of students increase (Lancaster & Willis, 1994). Billings (1986) reports that CML can be justified when there are large numbers of students, ongoing enrollment, when turnover is high, when orientation is conducted on an ongoing basis and when the courseware can be used by a large audience. Computer-based training for individual students can be very economical when the training content is stable and when students are very widely distributed (MacLeod & Costello, 1994).

In an experiment designed to evaluate a computer conferencing course in medical statistics, Ostbye (1989) found that this method of instruction allowed students to be involved in an interactive learning environment at a very low cost. Criddle (1995) also reported that the cost savings for a continuing nursing education program resulted mainly from the elimination of staff-related costs, elimination of paper costs, elimination of annual update costs, reduction of nurse educators' time, and reduction of managerial time. Richardson and Norris (1997) reported that the most significant costs for the Internet CME provider was the initial amount of time and money to maintain an Internet presence and to produce the educational materials. Thompson (1996) also discussed the use of the Internet for continuing education and concluded that it offered a means of cheap distribution of educational material and evaluations to the learner.

The use of HTML based hypermedia for courseware production allows quick and cost-efficient editing and distribution of educational material (Schulz, Shrader & Klar, 1997). Marks-Maran (1998) reported that an advantage of online CME was the low costs which were involved in updating and maintaining instructional material. In an experiment designed to assess the interest, need and market for online CME courses, Richardson and Norris (1997) found that most physician responders were willing to pay a median amount of $10 per credit hour.

Access to CME courses via a computer from home or the office also eliminates the need to travel, saving the professional both time and money (Plank, 1998; Caldwell, 1981; Jewett et al., 1998; Masten & Conover, 1990; Ferrance-Porter, 1978). Professionals who work and reside in remote areas are now able to participate in continuing education courses in their own communities (Twigg & Brennan, 1990; Palmer, Cumpston, Ruskin & Jones, 1997; Eager, 1997; Pankaskie & Sullivan, 1998; Ward 1997; Farmer & Richardson, 1997; Willy, Sterk, Schwarz & Gerngross, 1998; Landis & Wainwright, 1996). The Internet makes access to information global, thus small rural institutions with limited resources have access to the same quality and quantity of information as larger well-funded institutions (Klatt & Dennis, 1998). Many of the barriers between disciplines, professions and localities are eliminated as are the gaps that exist between researcher and practitioner (Hardey, 1996).

Learning Outcomes

The initial concern of applying or participating in any CML program is whether or not it will result in an actual increase in knowledge. Several studies have reported learning outcome results which suggest that CAI programs are very effective in increasing learning. Neafsey (1998), in his evaluation of a home study course for nurses on the pharmacology of alcohol, reported a significant effect on knowledge scores which increased from a pretest mean of 48.89 (SD = 12.31) to 97.22 (SD = 5.74) posttest (p = .0000). Neafsey (1997) also found very similar increases in a study on a CML program for nurses on pharmacokinetics. Scores for this group of learners increased from 45.22 (SD = 15.70) on the pretest to 97.22 (SD = 7.97) on the posttest.

Howard (1987) investigated the cognitive gain in nurses from the use of a computerized cardiopulmonary arrest simulation and reported a significant mean increase on the cognitive test score from 12.4 (SD = 1.9) for the pretest to 13.2(SD = 1.8) for the posttest ($p<0.001$). In a study designed to evaluate the effectiveness of CML case-studies for pharmacy continuing education, Jim et al. (1982) found that mean test scores increased significantly from 55.8% on the pretest to 80.4% on the posttest ($p<.0001$). Other studies without pretests, without statistics or with partial significant results (selected modules show increases while others do not) have also reported increases in knowledge after the use of a CML programs (Lee, Ault, Kirk & Comstock, 1995; Davis, 1998; Pogue, 1982; Wieczorek, Price & Cannon, 1998; Valish & Boyd, 1975: Bayne & Bindler, 1997).

A small number of studies also reveal that participants have reported behavioral changes after the completion of CML programs. Hulsman, Ros, Janssen and Winnubst (1997) indicated that 50% of medical specialists who completed a CAI course on 'Communication Skills for Medical Specialists in Oncology' reported they changed their communication behaviors as a result of the program. Jack-Scott (1994) found that 46% of physicians who had participated in a 'Core Content of Emergency Medicine' course reported they were incorporating into their practices some of the things they had learned in the courseware. Eighteen percent said they were considering incorporating something from the courseware into their practice.

In the literature there are several reports which have compared computer-assisted instruction to other, more traditional means of instruction. Barker, Klutman, Scott and White (1987) conducted a study to compare the effectiveness of CML versus the use of print information as a method for delivering continuing education. The investigators reported that CML participants learned and retained as much as those who received print instruction. The CML group scores in this particular study increased from a mean of 16.0 (53.3%) for the pretest to a mean of 26.3 (87.7%) for the posttest. Lawson, Shepherd and Gardner (1991) also found a significant increase in scores, from the pretest to the posttest, for pharmacists assigned to a computer simulation instruction group and those assigned to a traditional teaching group, with no significant difference in scores between the groups. Valish & Boyd (1975) reported no significant difference in performance between nurses who took a CAI program and those who learned in a face-to-face classroom.

Some of the studies which have evaluated CML programs have included a follow-up test, at some period after the posttest, as an attempt to measure any increase in knowledge retention that may have resulted from the use of a CAI program. Neafsey (1998) found that nurses participating in a home study program on the pharmacology of alcohol showed a significant decline in cognitive scores 5 months post CML learning compared to the immediate post CAI learning ($p = .0000$).

The 5 month score, however, was still significantly higher than pre-test scores (p = .0000). Similar results were found by Barker, Klutman, Scott and White (1987) who compared the effectiveness of CML versus print material. In this study a retention test was given two weeks after the posttest and the results revealed a significant decrease in scores from the posttest to the retention test. The print group dropped from a mean of 25.4 (84.7%) for the posttest to a mean of 23.4 (78.2%) for the retention test. The CAI group dropped from a mean of 26.3 (87.7%) for the posttest to a mean of 24.6 (81.9%) for the retention test. Both groups did retain a statistically significant amount of material after the two weeks when compared to the pretest.

In a study to investigate the effectiveness of CML for continuing pharmacy education, Jim et al. (1982) also found that a follow-up posttest was still significantly higher than a pretest ($p<.001$), but not significantly different than the immediate posttest ($p>0.2$). The same findings were also reported by Lawson, Shepherd and Gardner (1991), who compared computer simulation instruction to traditional teaching. Once again, the investigators found no significant difference, for either group, between the posttest mean and the follow-up test mean. The follow-up test mean was, however, significantly higher than the pretest mean (for traditional instruction; $t = -3.26$, $p = 0.003$, for computer simulation; $t = -3.46$, $p = 0.002$).

Researchers have also found that the confidence (self-efficacy) level of learners increases after participation in a CML program. Neafsey (1997, 1998) found that self-efficacy (SE) scores increased significantly from the pretest to the posttest for nurses taking a pharmacology of alcohol home study course (from 2.36 pre to 3.87 post; $p = .0000$). Neafsey (1998) also reported a significant decrease in SE scores 5 months post CAI home study compared to the immediate posttest ($p = .0000$). The 5 month post SE scores were, however, significantly higher than the pretest SE scores ($p = .006$). Howard (1987) also reported an increase in confidence scores, from a pretest to posttest for nurses using a computerized cardiopulmonary arrest simulation ($t = 5.08$, $p< .001$). These results suggested that the learners were more confident in their competencies and abilities in the area of cardiopulmonary resuscitation.

Another outcome from the use of CML reported in the literature, is an increase in the computer skills reported by program participants. Pharmacists enrolled in a CAI course on literature evaluation, drug information and biostatistics reported an improvement in computer skills over the course of the semester (Petzinger-Kaplan, Radonic-Patten & Hamilton, 1996). A similar result was reported in a study by Landis and Wainwright (1996) who found that health professionals believed that their competency in using computer conferencing had improved significantly and that they were more comfortable communicating with faculty by computer mediated communications.

Participant Satisfaction

Another measure of learning effectiveness relates to a learner's level of satisfaction with an instructional experience. Many studies have revealed that learners are generally satisfied with the use of CML programs. Neafsey (1997, 1998) reported mean satisfaction scores of 4.19 (SD = .56) and 4.22 (SD = .38) on a five point scale for nurses taking pharmacokinetics and pharmacology CML modules related to alcohol abuse. Harless et al. (1969) also reported that physicians in a post-graduate course considered CML to be significantly higher than educational television and programmed instruction in both the "Desirable" and "Appropriate" categories of quality. Ninety-seven percent of physicians participating in a course on emergency medicine rated CML as "Effective" and 72% rated it "Very Effective" (Jack-Scott, 1994). In another study by Pengov, Wright and Foreman (1979), 69.2% of physicians and residents participating in a course on the Core Content Review in Family Medicine, rated their satisfaction with the CAI course as "Excellent" or "Good".

Alves (1995) reported that 100% of physicians, who had responded to a survey after completing a CD-ROM program, indicated that this form of CML was an appropriate way to earn CME. Wedge (1994) reported that nurses who completed a CAI course on intramuscular injection sites rated the program as useful and they indicated a very high level of comfort with the use of the program (i.e. users experienced minimal anxiety when using the program -- comfort subscale = 5.7416, sd = 1.2668, on a scale of seven). The findings from another study involving physicians in Hawaii, indicated that CML was an acceptable method of CME and that in the absence of live patients and live teachers, this mode of instruction fulfilled many of the physicians continuing education needs (Tinsley & Easa, 1986).

In another study, Kripalani, Cooper, Weinberg & Laufman (1997) reported that physicians did not rate computer-assisted continuing medical education (CACME) any better or worse than other instructional delivery methods. However, when the responses were analyzed separately, physicians with prior computer usage experience gave significantly higher ratings to CACME courses than their counterparts with no prior computer use.

Many investigators have also reported positive survey responses related to health care provider's use and satisfaction with CML programs (Parry-Bush, 1993; Mottram, Rowe & Stanley, 1993; Hulsman, Ros, Janssen & Winnubst, 1997; Bittorf, Bauer, Simon & Diepgen, 1997; Lee, Ault, Kirk, Comstock, 1995; Davis, 1998). Seventy-five percent of pharmacists who completed a CML course on anticoagulant therapy felt the CAI approach was stimulating and fun (Jim et al., 1982). Pharmacy practitioners who participated in a patient medication simulation program indicated that the simulations adequately tested their knowledge and that they would recommend them to colleagues (MacKinnon, Pitterle, Boh & DeMuth, 1992). Criddle (1995) reported that 94% of nurses and nurse managers who participated in CAI courses on "Preventing AIDS and Hepatitis B in the Workplace, Back Injury Prevention, and Hospital Fire Safety" believed that the use of computer-based questioning assisted their learning. Several researchers have also reported that a majority of participants who used CML programs for continuing education would continue to choose CAI programs in the future as a means of obtaining CE credit (Neafsey, 1998; Barker, Klutman, Scott & White, 1987; Pengrov, Wright & Forman, 1979; Alves, 1995).

5.6 Disadvantages of Computer-Assisted Learning and Instruction

Set-Up and Maintenance Costs

One of the main deterrents in providing or participating in computer-assisted education is related to the start-up and maintenance costs which can be involved (Russin & Davis, 1990; Kilmon, 1996; Heinrich, Fichandler & Cuono, 1988). The main expenses are usually incurred in the purchase of hardware and software (Schmaus, 1991; Pogue, 1982; Hannah et al., 1989), in the establishment of computer networks or connections with distant Internet Service Providers, or during the development of CML programs. For CE providers, expenses can increase significantly if the educational software is developed in-house (Billings, 1986).

Lack of Skills

Computer-mediated learning has become a relatively accepted form of continuing education in developed countries. Computers have become a common commodity in most health care settings, and a majority of health care professionals have access to a computer either through work or at home. Nevertheless, there are many health care professionals, particularly older and more experienced practitioners, who have not yet accepted the role of computer technology in their practices. Bayne and Bindler (1997) found that many nurses in a medication calculation course were not comfortable, and were even anxious, about using computers for continuing education. Cragg (1994) conducted a study to test the effectiveness of computer-mediated conferencing as an option for distance education and found that despite an introductory workshop, nurses had many problems logging on to the system and learning to upload and download the material. All seven nurses in the course reported that difficulties with the technology caused them to become extremely frustrated. This frustration did, however, turn into pride by the end of the course when all reported to have mastered the system enough to be able to participate fully. Farmer and Richardson (1997) carried out a study to determine remote nurses

perceptions of the potential of the Internet to improve access to information. Many nurses frequently reported a "lack of appropriate skill to seek information properly" as a common concern.

The successful implementation of computer-assisted learning calls for a change in the roles for both learners and educators. Both parties must become computer literate (Hekelman, Niles & Brennan, 1994) and, in addition, instructors must also learn skills for becoming managers of instruction (Billings, 1986). Educators who have traditionally enjoyed teaching in the face-to-face setting are not required to perform in the same manner in CML environments (Schmaus, 1991). Instructors in CAI continuing education courses are often forced to change the way they have designed the curricula, developed courses, taught and assessed learning outcomes, interacted and related to students, and managed their time. Learners, as well, must become more responsible for their own learning, which includes learning how to use information technology in order to participate effectively in a course.

Another concern for providers of CML continuing education courses focusses on the skilled professionals that are often required to design and develop high quality programs. Schulz (1997) reports that the production of a high-quality computer-based training program requires a team of programmers, subject matter experts, instructional designers, and multimedia production professionals. Often, the development process is extensive and Heinrich, Fichandler and Cuono (1988) state that the two major disadvantages of CML programs are the number of hours required to develop a program, and the need to rely on skilled professionals in order to obtain a quality product.

Technical Limitations

The advances which are occurring in the communications and information technologies are proceeding at an enormous rate. What may be considered current and new technology today is out-of-date tomorrow or next week. This is no exaggeration, particularly when we speak of computer processing speeds and memory capacities. These rapid developments and changes are a primary concern for health care professionals who use computers in their offices or from their homes. The systems which they may like or intend to use are not always compatible with the educational courseware being supplied to them. Technical and communication system limitations (old computers, slow phone lines, modems, etc.) are considered to be a main disadvantage of CML, particularly programs which are offered over the Internet (Veldenz & Dennis, 1998; Richardson & Norris, 1997; Pankaskie & Sullivan, 1998). In many instances, health care professionals who are planing to participate in CML continuing education courses are required to have an up-to-date computer with the latest capabilities (Lancaster & Willis, 1994). In a study which compared CAI to print instruction, participating pharmacists reported that the main disadvantages of the CML program were related to their slow computer response time (Barker, Klutman, Scott & White, 1987).

Security

Horn et al. (1997) indicate that a valid concern for professionals participating in World Wide Web (WWW) CME courses is the secure transmission of personal data such as name, address, or phone numbers. For some physicians, the perception that their need for a refresher course on a certain topic may be misinterpreted as a lack of competence in that area is concerning. Another concern is related to the secure transmission of payment for online courses (Pankaskie & Sullivan, 1998). Anthony (1997) states that a major limitation of using some learning networks in nursing education is the lack of security. Anthony offers several possible solutions to reducing security threats including the use of a secure network system, the provision of passwords, and the education of learners concerning the need to protect passwords and user names.

Validity and Reliability of Information

Some concerns have surfaced regarding the use of the Internet in providing continuing medical education. One of the primary concerns reported in the literature deals with the validity of information which has been placed on the Web. It is well understood that anyone with a computer and a modem and rights to publish material on a server can access the Web. It is important to ensure that any acquired information is from a reliable source (LaRocque, 1998). Fiker (1996) emphasizes the importance of self-filtering and double-checking with appropriate authoritative sources, all information on the Internet. Baxter (1997) stresses the importance of ensuring that any course a health care professional is interested in has been accredited and will meet a medical or other health-related licensing board requirement for relicensure or recertification. Ruskin, Doyle and Engel (1996) emphasize that medical publication on the Internet will require a high level of quality control because the information will be available to anyone who cares to look. The authors suggest that creating a peer-review system for electronic information may help to enhance academic recognition of the medical resources which are available online.

Medical science information is also being updated at a record pace. Therefore, CML programs, which are designed to advance medical knowledge, must be continuously updated and maintained. MacKinnon, Pitterle, Boh and DeMuth (1992) report that the two main limitations of simulation-based CML programs are their inability to capture all possible variables and the fact that practice standards and therapeutic options are constantly changing. In some ways, these problems are being addressed by the application and use of Internet and other online programs, which offer providers quick and easy access for the updating of material (see CAI advantages).

Lack of Access

What about those who do not have an Internet connection? Veldenz and Dennis (1998) believe that a major disadvantage of Internet-based continuing education is that educational information placed on the Internet will be unused and unread if participants, for whatever reason, are unable to obtain access. Hardey (1996) reports that a majority of rural practitioners do not have easy access to a computer capable of accessing the Internet, and are thereby unable to realize the potential of the Internet in continuing education. A lack of access to computers has been reported by several authors in the literature (Kilmon, 1996; MacFarlane, Cuevas, Moody, Russell & Schlecht, 1996) as have reports citing a lack of current program offerings in continuing education areas for health care professionals (Richardson & Norris, 1997; Billings, 1986; Masse-Holbert and Sudia-Robinson, 1992; Hannah et al. 1989).

Pedagogical Constraints

The inability to provide skill instruction has also been reported as a disadvantage of CML. Lancaster and Willis (1994) state that CAI can provide instruction on cognitive aspects of psychomotor skills, but to actually acquire a skill requires practice and evaluation with an instructor or preceptor. Something which a computer is unable to provide. Similarly, the computer's current inability to deliver information from the tactile domain has also been noted as a disadvantage of CML (Veldenz & Dennis, 1998). Because of these weaknesses, several authors have considered CAI to be an impersonal method of instruction, and Billings (1986) has referred to CML as a method of instruction that is high tech without high touch.

5.7 Planning and Managing CML

Many authors have offered suggestions, tips, or recommendations for those who are considering the design, development, and offering of computer-mediated learning programs. In this section, some of the suggestions which have been offered and the sources of the lessons learned, experiences, and resources identified in the literature are outlined. The reader is directed to consult these resources for further information.

Needs Assessments

An important and fundamental recommendation provided by many authors for designing and developing any CML program is to assess what knowledge is required, and to determine how the information should be presented. Hodson-Carlton (1997) explained that the delivery method should be selected based on the needs of the target population, the content, and the situational context. One way to determine this information is to conduct a needs assessment/feasibility study. Russin and Davis (1990) carried out a feasibility study for the use of an electronic bulletin board system in the continuing education of nurses. By carrying out this study, the authors were able to determine the services which were most used and desired by the participants, the availability of resources, the fees that participants would be willing to pay, and the degree of interest in the particular program. In a similar study, Richardson and Norris (1997) carried out an online needs assessment and were able to determine the level of interest in CME, how many hours of study the participants desired, how much they were willing to pay, and topics of interest.

Measuring Outcomes of CML

In order for a program to be successful, it must be relevant, effective, and an efficient means for participating in a learning activity (Storey, 1986). Koch and Rankin (1985) conclude that the critical and reflective evaluation of CML programs is required in order to allow for their refinement, modification, and future development so that the maximum benefits from the course can be obtained.

Barnes (1998) suggests that continuing medical education must become a means for improving patient outcomes through enhanced physician performance. Therefore, the ultimate goal of CME is not just to teach information, but it is also to ensure that the new knowledge is applied to clinical practice. Neafsey (1998) suggests that longitudinal studies in which knowledge, practitioner's self efficacy, and behavior is measured over a period of time after a program has been completed are required. Lawson, Shepherd, and Gardner (1991) also suggest the use of more sophisticated target outcomes, such as resulting practice effects (e.g. financial position of pharmacy at some date after a course in pharmacy financial management) as a means for determining the overall impact or outcomes of computer-based training.

Rather than relying on follow-up surveys to determine whether a CAI program has indeed changed a practitioner's performance, some authors have argued in favour of programs which facilitate the transfer of clinical information directly to the daily practice of health care practitioners. The basic idea behind this argument is that the more clinical-like the learning situation, the higher the chance that the learner will actually apply the new information in their practice. Therefore, programs which are patient-oriented rather than subject-oriented will be more meaningful to the practitioner. As an example, practice-based learning programs in which the physician must reflect on his or her practice in order to identify learning opportunities which are most meaningful and beneficial (Barnes, 1998). However, much more work and study is needed in this area to identify the best means for transferring the theory of practice-based learning to the medium of computer-mediated learning.

Development and Design Tips

Many authors have provided helpful tips for the development, selection, and use of the various computer technologies in providing continuing education for the health professional. The basics of the World Wide Web, accessing information on the Web, and/or how to use the Web in health education have become common topics in the literature. The following tables provide an overview of some valuable resources which continuing education providers may refer to for information on best practices and design and development tips related to CML for health care professionals.

Criteria for Selecting CML Programs
Hoffer (1989)
Petzinger-Kaplan, Radonic-Patton & Hamilton (1996)
Daly, Nicholls, Brain, Grassby & Temple (1990)
Adsit (1996)
Nerlich (1995)
Rodriguez, Petryshen, Petryshen & Pelekis (1992)
Anthony (1997)
Evans & Cowley (1985)
Schmaus (1991)
MacFarlane, Cuevas, Moody, Russell & Schlecht (1996)
Bergeron (1998)
Chao (1992)
Keckan (1997)
Billings (1988)
O'Toole (1993)
Posel (1993)

World Wide Web and Web-Based Education Systems

Poss, Koris, Santore & Mevis, (1995)
Tynan, (1997)
Yerks, (1996)
Hayden, (1997)
Costaridou, Panayiotakis, Sakellaropoulos, Cavouras & Dimopoulos, (1998)
McEnery, (1995)
Haynes, (1997)
Lugo-Vicente, (1997)
Burnham, (1996)
Gallagher & McFarland, (1996)
Spooner, (1995)
Hutchinson, (1997)
Sullivan, (1996)

Several authors have also offered tips on best practices for designing and providing individualized-types of CAI. Sheridan and Legros (1995) offer recommendations on how to develop and send instructional modules through electronic mail. Piemme (1998) describes the characteristics of an effective clinical computer simulation program. Shortliffe (1983) provides an overview of six design features that physicians have rated as most important in consultation systems, and Carroll (1997) offers a framework of production steps that should be included in the writing and evaluation of computer-based training programs. Several points to consider when converting material from a traditional staff education model to a multimedia instructional delivery model have been also described in the literature (Price & Reis-Wieczorek, 1995; Tronni & Prawlucki, 1998; Hodson-Karlton, 1995; Buisson, 1985).

As discussed previously in this report, a major concern regarding the implementation of CML for continuing education in the health professions is the fact that many health care professionals are simply not comfortable with the use of computers for learning. Researchers have found, however, that increased levels of positive experiences with CAI increases a learner's belief in the desirability and appropriateness of this form of instruction (Harless et al., 1969). Landis and Wainwright (1996) found that students who had participated in a computer conferencing course gained competency in learning new technological applications and were more comfortable with the technology after its use. Therefore, those who are willing to participate will, no doubt, learn the material provided in the course and will additionally benefit by becoming more self-confident and competent users of

CAI.

The importance of CML in continuing education in the health professions was stated clearly in a recommendation by Masys (1998). Masys claimed that the use of information technologies was an essential component for evidence-based medicine and it needed to be woven throughout the fabric of undergraduate, graduate and continuing medical education. If this is conducted in a systematic and effective manner, it is likely that physicians and other health care professionals will be adept and equally prepared to participate in the various forms of computer-based learning programs which are becoming available. As designers and providers of these forms of instruction, our role is to provide adult learners with the opportunities to succeed in moderately challenging instructional situations. CML courseware should be designed to promote learners' perceptions of computer self-efficacy and to encourage a continuing motivation to learn. As well, furnishing learners with significant amounts of learning control and the ability to exercise it can contribute to positive learning outcomes in computer-mediated learning.

Appendix A
Summary of Experimental Research Reviewed

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Abbey J. (1987)	Distance education: an option for geriatric nurses	Print	15 nurses from country areas of Australia.	To describe the development, implementation and evaluation of a distance education program in geriatric nursing.	The course materials and support provided were considered very effective. Students were concerned about self-confidence and the lack of grading, feedback, study skills and evaluation of clinical competency. Students preferred external objective assessment rather than self-assessment.
Alves T. (1995)	Using a CD-ROM to deliver a series of CME programs	Computer	physicians	To discuss the Silver Platter CME programs becoming available on CD-ROM. The paper also mentions a research project consisting of an attitudinal survey on the appropriateness of CD-ROM CME.	Respondents felt that CD-ROM was an appropriate way to earn CME. Large majority said they would probably use CD-ROM to get CME in the future and that the CD-ROM sent to them was a good way to earn CME credit.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Anderson D, Harris M, McCosker H. (1997)	Violence against women: An education program for rural community health workers	Audioteleconferencing	nurses, physicians, social workers, psychologists, allied health professionals	To identify a distance education delivery system for addressing the educational needs of community-based rural health professionals regarding violence against women.	Distance learning programs need to highlight the rural issues that impact on service delivery and affect appropriate health interventions in cases of violence against women.
Anneroth G. (1994)	Worldwide survey on distance learning in dental education.	Audio and Video	dentists	This paper reports the results of a worldwide survey on distance learning initiated by the FDI.	Programs are provided mainly by national dental associations and dental schools. In most countries, dentists have access to equipment which would enable them to participate in DL programs. Most countries reported a strong interest in making use of DL programs. Advantages of DL reported include their capacity to decrease costs and provide most current information.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Anthony DM. (1997)	The value of computer networks in nursing	Computer	355 nurses	To discuss the actual and potential use of computer networks to enhance clinical practice, including a survey to determine UK nurses' experiences, views and policies on computer networks, their access to such networks and the uses of these networks.	The most common type of system accessible to nurses was patient administration systems (PAS). Nurses rated accessing databases and nursing notes as the two most important functions of networks in nursing. Online courses, videoconferencing and links to other countries were ranked as least important.
Barker JL, Klutman NE, Scott BE, White SJ. (1987)	A comparison of computer-assisted instruction and printed information as methods of pharmacy continuing education	Computer vs. Print	46 hospital pharmacists (23 PI group, 23 CAI group) from four hospitals in Kansas	To compare the effectiveness of CAI versus printed information (PI) as methods for delivering CE.	Both print and CAI groups showed a significant increase in posttest scores over pretest scores. The follow-up score for both groups was significantly less than the posttest score, but remained significantly higher than the pretest score. CAI participants learned and retained as much as those who received print instruction.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Bayne T, Bindler R. (1997)	Effectiveness of medication calculation enhancement methods with nurses	Computer, self-study workbooks and classroom instruction	200 nurses selected randomly from 3 hospitals in Washington State	To test the effectiveness of three instructional methods to improve medication calculation skills of practicing RNs.	Scores improved most for the classroom group. CAI scores improved slightly. CAI group indicated least level of satisfaction, while self-study workbook group showed highest level of satisfaction.
Bergvik S, Gammon D. (1997)	Video Conferencing in group training of Psychiatric Nurses.	Videoconferencing	nurses	To determine the effectiveness of video conferencing in providing supervisory-level training to nurses in Northern Norway.	Results indicate that VC may indeed be an acceptable tool in group supervision. Participants reported that they were able to establish a climate for communicating on an emotional and personal level, as well as provide the necessary feedback and psychological support.
Bernard R, & Naidu S. (1990)	Enhancing interpersonal communication in distance education: Can "voice-mail" help?	print, correspondence course	nurses	To determine the need for voice-mail support for print-based distance education courses.	The results suggest that communication is occurring between and among students in the program; respondents' reaction to the potential usefulness of voice-mail communication in the program was extremely favourable.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Billings D, Durham JD, Finke L, Boland D, Manz B, Smith S. (1994)	Collaboration in distance education between nursing schools and hospitals.	interactive television	nurses	The study reported was conducted to gain a better understanding of ITV as an educational tool from the perspective of students, faculty, administrators, and ITV coordinators at host hospital sites and regional nursing schools.	The respondents, 15 site coordinators, were generally satisfied with the operational aspects of ITV. Concerns raised by respondents included classroom space availability, operational costs, library resources, and communication equipment and processes.
Bittorf A, Bauer J, Simon M, Diepgen TL. (1997)	Web-based training modules in dermatology	Computer	Anyone who accessed the Web site could complete the online survey. 199 questionnaires were completed correctly between May 10 and July 10, 1996	To discuss the development of an intensive system for training in dermatology	The number of requests for access had increased dramatically during the past few years. Online atlas received the most requests for access. Approximately one half of the respondents used the system for CME. Ninety-eight percent of the ratings regarding the server ranged from good to excellent.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Blank JW, Kirk KW, Weinswig. (1975)	Evaluation of an audio cassette tape lecture course	audio cassettes	pharmacists	An evaluation was conducted to determine if the cassette courses were acceptable, if a gain in cognitive knowledge could be demonstrated, and what strengths and weaknesses were perceived in the product and its design.	A statistically significant gain in cognitive knowledge from pretest to posttest was found. Pharmacists strongly agreed that the program was a satisfactory and convenient means for learning, and majority indicated they would recommend the technique to a colleague.
Boh LE, Pitterle ME, De Muth JE. (1990)	Evaluation of an Integrated Audio Cassette and Computer Based Patient Simulation Learning Program	audio cassette, computer-based training	pharmacists	The evaluative goal of this project was to assess the impact of the course in terms of the pharmacist's satisfaction, knowledge gain, and ability to apply medication problem solving skills to direct patient care.	Experimental group expressed satisfaction with the computer simulations portion of the course, however the time required to learn how to use the patient simulations was too long. Both the control and experimental groups scored equally on the pretest and showed significant increase in knowledge, however the experimental respondents scored significantly better that the control group on the posttest.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Bolte IM, Fleming JW. (1971)	A Study of registered nurses who viewed the PANMED television program series in nursing	television	nurses	The purpose of this study was to determine some characteristics of the registered nurses in Kentucy who viewed or had heard of the PANMED television series in nursing and their perceptions of the series.	Nurses employed less than one year saw the program more than other nurses and most viewers were employed in hospitals. Reasons for not watching the programs included not knowing about it, inability to get the series on their TVs, working or not at home during broadcasts. Majority of viewers rated the programs as very useful or useful.
Boswell EJ, Lorenz RA, Pichert JW, Schlundt DG, Penha MLI. (1994)	Evaluation of a home study continuing education program on patient teaching skills	Print and videotape	28 subjects: 25 women and 3 men signed up for the course, only one participant completed the entire course.	To describe the development and formative evaluation of a home study version of the Effective Patient Teaching course.	Enrollment and completion of the course were disappointing and no statistical tests could be applied.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Braucher CL. (1971)	Trends in Pharmaceutical Continuing Education	correspondence courses, closed circuit TV, formal meeting or seminar, film, telephone, tape recordings, programmed instruction	54 schools responded to the survey	To report trends and activities among university providers in pharmacy continuing education during the year of 1969.	Total hours of programming are continuing to increase. Greater variety of subjects being offered. Total program participants have increased. Formal meeting or seminars remained the most popular program. 2/3 of programs in pharmacy CE now being cooperatively sponsored with outside agencies. Correspondence course offerings continue to show no definite acceptance trends.
Burleson S, Sugimoto T. (1984)	Cancer Education via Video-Teleconferencing: An Assessment of Participant Responses	television	nurses, community-based health professionals, pharmacists, social workers	To evaluate participant satisfaction with the use of a statewide closed-circuit television system for the dissemination of current cancer information.	87.8% agreed that the program content would be useful to their practice, and 94.3% agreed they would recommend video-teleconferencing as an effective method for continuing cancer education.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Byers DL, Hilgenberg CS, Rhodes DM. J. (1996)	Evaluation of Interactive Television Continuing Education Programs for Health-Care Professionals.	Interactive television - (two-way audio and two-way video system)	physicians, nurses, pharmacists, and emergency medical technicians	This study describes the evaluation of live two-way interactive television (ITV) continuing education programs for health-care professionals.	Results indicated that these continuing education programs delivered through interactive television met the learning needs of participants, the interactivity of the system enhanced learning, and a majority would be likely to attend future professional education programs offered via ITV.
Connell CM, Smyer MA. (1986)	Telephone Conference Networks for Training in Mental Health.	telephone conference	physicians, nurses	To evaluate participants' satisfaction with a Telephone Conference network and effects of participation.	Large majority of participants would participate in other programs, highly recommend participation for others, and reported they would be able to use what they learned on the job. Main strengths were convenience and efficiency. Recommended that visual aids, diagrams, workbooks, and selected reading materials be incorporated into the program
Cook H. (1993)	Task based learning - the results of a pilot study	print	12 community pharmacists	To discuss the results of a pilot study to assess the use of task-based learning in a continuing education module on asthma for pharmacists.	Feedback on the task-based program was positive. Pharmacists felt that the task had enabled them to transfer knowledge gained from the course into practice. Participants felt more competent when talking to patients about their medications.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Cowell JM, Kahn EH, Bahrawy AA. (1992)	The School Nurse Development Program: An Experiment in Off-Site Delivery	teleconference	nurses	The purpose of this study was to evaluate the effectiveness of a teleconference program by comparing multiple program outcomes of learners enrolled at off-campus sites to on-campus learners	No significant difference between grades or satisfaction levels of the off-campus and on-campus learners. Learners at both sites were dissatisfied when equipment failed and several learners reported that they never adapted to the teleconferencing technology. Adequate orientation for faculty so they use the equipment in a way that provides the opportunity for interaction.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Cragg CE. (1994)	Nurses' experiences of a post-RN course by computer mediated conferencing: friendly users	computer	7 female nurses with an average age of forty years	To examine whether CME is a viable option for distance education for nurses and how nurses feel about taking a course by a new technological delivery strategy.	Despite introductory workshop, the students had many problems logging on and downloading information. By the end of the course students were proud they had mastered the system enough to participate fully. Several students reported that computer conferencing improved the quality of the class discussion. Students who would have been intimidated in a face-to-face class contributed on an equal basis. Participants' felt that they had performed as well as they would have in a classroom setting. Group interaction in CMC seemed to meet their learning needs.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Criddle LM. (1995)	Computer-assisted instruction: A successful approach to mandatory annual review education.	computer	375 nurses and 13 nurse managers	To investigate a CAI program that allows individualized education on the nursing unit during regular work hours and to determine if CAI decreased annual review costs and improved the quality of annual review education.	Majority felt that the information was presented at an appropriate pace, was understandable, well-organized, interesting and challenging. Feedback and computer questions were believed to have assisted the learning process. Both nurses and nurse managers felt that the system was an effective learning tool which would be useful for meeting mandatory annual review requirements.
Cuevas LE, Moody JB, Macfarlane SBJ, Rada R, Ghaoui C. (1993)	The use of hypertext: demonstration of the methods for investigating an epidemic of meningitis	computer	8 medical postgraduates and staff members	To evaluate the feasibility of using hypertext to assist in the education of health workers on the health problems in developing countries.	Difficult to draw any conclusions from such a small number of users, but the evaluation was useful in illustrating problems of the evaluation itself.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Davis KA. (1998)	Development and evaluation of computer-based training for pre/post Human Immunodeficiency Virus test counseling	computer	11 RN's with an interest in the topic (Pilot test). Seven participants returned the completed package.	To discuss the development and pilot testing of a computer-based instruction (CBI) program to train nurses and other healthcare providers in conducting HIV test counseling.	The scores for the 4 participants without prior training or experience in HIV test counseling were higher for the posttest than for the pretest. The scores of the 3 participants with prior experience or training did not improve after viewing the program. Most participants in the pilot evaluation were positive about the medium.
De Muth JE, Kirk KW, Weinswig MH. (1976)	Continuing Education for Non-Practising Professionals: A Case Study of a Program for Pharmacists.	audio cassettes	pharmacists	To develop and evaluate a distance continuing education course (audio cassette program) for non-practising pharmacists.	When provided with continuing education materials non-practising professionals can regain a level of knowledge comparable to that of their practising colleagues; cassette tapes with printed materials offered an effective and convenient method of professional continuing education

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
DeMuth JE, Weinswig MH, Vanfleet JS. (1983)	Evaluation of journal readings as a method of pharmacy continuing education	print	283 pharmacists out of 472 who had completed at least one course during 1978 or 1979	To evaluate the effectiveness and acceptability of one of several accredited journal courses. Objectives: 1) evaluate pharmacists satisfaction with various aspects of journal course learning. 2) evaluate changes in the students cognitive knowledge resulting from their participation. 3) identify possible ways to improve this type of continuing education.	Respondents strongly agreed that articles were an overall valuable learning experience. Licensure in a state with mandatory requirements for re-licensure significantly influenced the pharmacists' enrollment. Second most popular choice for continuing education was journal courses (first was face-to-face). Topics were covered in sufficient detail; articles were written at a level that was understandable; questions on final exam were representative of the material in each article. Pharmacists were more knowledgeable on information covered in articles they had studied.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
DeMuth JE, Weinswig MH. (1984)	Learners' evaluations of an accredited continuing education course in a pharmacy journal	print	461 pharmacists who completed at least four sessions in 1982	A second study was conducted to reevaluate the satisfaction of all enrollees using the same method as DeMuth, Weinswig, Van Fleet 1983. This second study included learners who completed less than an entire years work so that results would be more generalizable.	The journal course was valuable to practitioners and of utility in their interactions with other health professionals and patients. All aspects of the course were positively evaluated. Convenience appeared to be the most important feature.
De Muth JE. (1991)	National pharmacy survey on the availability of hardware required for continuing education delivery systems.	distance learning	pharmacists	The objectives of this study were to evaluate availability of equipment or devices required to facilitate the newer forms of CE (personal computers, video players).	92.7% of respondents have audio cassette player, 90.1 % have video players (VCRs), 70.9& had cable television, 51.9% had access to a personal computer. Most popular method of CE were accredited journal articles, live programs from pharmaceutical associations and schools of pharmacy were utilized most.

Author	Title	Type of Distance Education	Sample	Purpose	Findings
DeMuth JE. (1996)	Evaluation of an In-Depth Pharmacy Home Study Program	audio cassettes, print	pharmacists	To evaluate learners' overall satisfaction with the audio cassette program, to determine if there were significant differences in their evaluations based on selected demographic variables, and to compare responses of learners with evaluations of an original 1990 program.	Large majority agreed that the audio cassette learning package was a valuable learning experience and the information presented in the program would be useful in their practice. Cassette tape recordings represented a convenient and time saving means for professional CE.
Elsey B, McIntyre J. (1996)	Assessing a support and learning network for palliative care workers in a country area of South Australia.	telephone and videoconferencing	nurses, physicians and social workers	This paper describes and reviews a project designed to provide a support and learning network for palliative care workers in a country area of South Australia using telephone and interactive video conference facilities for communication purposes.	The evaluation indicated that a distance education approach was successful in developing an awareness of the need for good quality palliative care provision and fostering open lines of communication.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Evans CE, Haynes RB, Birkett NJ, Gilbert JR, Taylor DW, Sackett DL, Johnston ME, Hewson SA. (1986)	Does a mailed continuing education program improve physician performance? Results of a randomized trial in antihypertensive care	print	102 patients in study group, 81 patients in the control group 41 physicians in study group, 35 physicians in the control group	To design and execute an experiment testing a mailed continuing education program with control of hypertension as the prime outcome of interest.	Study demonstrates no influence of a mailed continuing education program on the practices of physicians or on the control of blood pressure of hypertensive patients referred from a community survey to these physicians after the program was begun.
Fahs IJ, Miller WR. (1970)	Continuing Medical Education and Educational Television: An Evaluation of a Series for Physicians in Minnesota	broadcast television	physicians	To evaluate the effectiveness of broadcast television in providing CME to physicians.	Estimated that 1,000 Minnesota physicians watched one or more programs - majority watched one to four programs (70%), 25% watched 5 - 10 programs, 7% watched 11 - 30 programs. Most of the physicians considered the material to be relevant to their practice. Programs could not retain the viewers' interests and improvements required in audio-visuals and camera work. Requests for audience-involvement, live telecast rather than pretaped programs, open line for questions from the audience, making literature available upon request.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Farmer J, Richardson A. (1997)	Information for trained nurses in remote areas: do electronically networked resources provide an answer?	computer	71 community nurses, midwives and health visitors working in the Western Isles (questionnaire), 51 people attended the workshop	To report on a research project which examined the potential of the Internet and other networked information resources, to improve access to information for trained nurses working in remote areas.	Nurses in the study wanted to learn more about information technology. Participants realized the potential of the Internet, e-mail and online discussion groups. Lack of time and appropriate skills to seek information properly were frequently highlighted by participants.
Fiene MA, Fannon M, Drewry S, Spahn MA. (1984)	Development of professional competence via self-instructional units	print	Faculty of the School of Medical Technology, 240 workshop participants	To develop a practical concrete process for developing self-instructional units and then share this process with other allied health professionals in a series of workshops.	Self-instructional units can be of benefit to four groups of people; students, educators, professional organizations, consumers in health care system. SIUs can be effectively used for continuing education credit, as "refresher" material for professionals returning to practice, and revised as the needs of a professional group change.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Friesen AJD, Zinyk DE, Mah G. (1985)	Mandatory continuing pharmacy education in Alberta, Canada: The response to live programs and correspondence courses	print	425 pharmacists randomly selected from a total of 1713 who completed the same three year CE period between 1979 and 1982	To determine the total number of CEU's accumulated in a given 3 year period and ascertain what portion were obtained by attendance at live programs versus examination oriented correspondence courses.	Seventy-three percent of total CEUs obtained by examination-oriented correspondence courses. Those over age 40 attended more live programs. Females attended fewer live programs and obtained an average of 9 more CEUs than men.
Gruppen LD, Hutchinson SP, Gordon PJ, Roser S. (1996)	An Evaluation of the Efficacy of Interactive Videoconferencing in Residency and Continuing Education	videoconferencing	physicians	To evaluate the effectiveness of satellite videoconference broadcasts in providing continuing medical education in oral and maxillofacial surgery.	Participants showed statistically and educationally significant increases in knowledge attributable to the broadcast, increased confidence in their knowledge of and ability to treat medical problems, and participants rated the satellite broadcast as more effective than traditional methods.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Hampton CL, Maxmanian PE, Smith TJ. (1994)	The Interactive Videoconference: An Effective CME Delivery System	satellite videoconferencing	nurses, physicians and other health care professionals	To study the effectiveness of videoconferencing technology as a means for continuing education.	Significant pre to posttest difference in knowledge acquisition, majority of participants indicated they would make changes in their practice as a result of the videoconference, and although the study did document financial benefits it seems likely that videoconferencing is a more cost-effective way of delivering CE.
Harless WG, Lucas NC, Cutter JA, Duncan RC, White JM, Brandt EN. (1969)	Computer-assisted instruction in continuing medical education	computer versus programmed instruction and educational television	14 physicians in a post-graduate course at the University of Oklahoma Medical Center	To conduct a systematic study of the potential of computer assisted instruction in continuing medical education.	CAI rated as more "desirable" and "appropriate" than programmed instruction and educational television and was more "appropriate" and "desirable" after completion of the CAI program than it was before the program began.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Hart G. (1989)	Teleconferencing: peer support for new graduates and preceptors.	telephone conferencing	nurses and nurse preceptors	Teleconferencing was trialed as a means of providing peer support to preceptors and graduates participating in a graduate transition program.	Majority of participants were satisfied with the use of telephone conferencing to have contact with other nurses and share experiences. Effective teleconferencing requires a skilled chairperson who encourages participation. With practice, participants become familiar with the teleconference format and more confident about initiating discussion.
Hibbard BM, Marshall RJ, Hayes TM. (1986)	Postgraduate medical education by distance learning	audio teleconferencing	physicians	To evaluate the efficacy of teleconferencing technology for postgraduate continuing medical education by using a participant reaction questionnaire and observing interactions.	Results did show that discussion tended to be one-way - from teacher to student - students raised very few questions or points of discussion. Majority of students felt that this form of learning was an acceptable alternative to having to travel to the nearest teaching site. Teachers had to give more time to the preparation of their material. Relative anonymity of the system encouraged those who would otherwise be silent at a conventional seminar.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Hoskins G, Neville RG, Smith B, Clarke RA. (1997)	Does participation in distance learning and audit improve the care of patients with acute asthma attacks?	print	91 GPs completed an audit cycle and reported data on 782 patients with asthma attacks in 1991-92 and 669 in 1992-93	To test whether GPs who completed an audit cycle encompassing a data recording exercise, distance learning program and personalized feedback changed their management of patients with acute asthma attacks.	Management of patients with acute asthma attacks changed according to the recommended guidelines and audit feedback suggestions.
Houston H, Beck L. (1995)	Distance learning package for eye disease	video & audio	207 Welsh general practitioners. 203 completed the course.	To discuss the development and evaluation of a distance learning package related to eye disease for general practitioners.	There was a significant increase in knowledge: mean mark of 54.4% among respondents before the course compared to a mean of 85.5% afterwards (paired t-test, p<0.01). There was a significant improvement in theoretical patient management decisions, mean mark among respondents rising from 66.2% to 78.6%, (paired t-test, p<0.01). These results were sustained at two months.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Howard EP. (1987)	Use of a computer simulation for the continuing education of registered nurses	computer	97 registered nurses employed full time in a 460-bed hospital. All subjects worked on medical nursing units.	To investigate the cognitive and affective gains from the use of a computerized cardiopulmonary arrest simulation.	Cognitive and confidence posttest scores significantly higher than pre-test scores. Simulation was considered to be practical, emotionally appealing, and interesting.
Hulsman RL, Ros WJG, Janssen M, Winnubst JAM. (1997)	INTERACT-CANCER. The development and evaluation of a computer-assisted course on communication skills for medical specialists in oncology	computer	33 medical specialists	This study focuses on the development and evaluation of Interact-Cancer; a computer-assisted instruction program that provides training in communication skills for medical specialists.	Course was evaluated as meaningful, relevant to daily practice and recommended to fellow specialists. Half of the participants reported changed behavior as a result of the course. Instruction method, theory and video examples were particularly well received. Approximately half of the participants reported that the course took a lot of time at the expense of other activities.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Hunter AT, Portis B. (1972)	Medical Educational Television Survey	broadcast television	physicians	To assess the level of viewership of CME broadcasts among urban and rural physicians.	50 % (900 - 1,000) of respondents watched at least one television broadcast and half of these could be regarded as regular viewers. Doctors who acknowledge difficulty in keeping abreast of current medical information appear to be more interested in watching METV as well as in taking part in other organized programs of CME. Viewers did not feel that the full educational potential of the medium was being fulfilled
Jack Scott C. (1994)	Applied adult learning theory: Broadening traditional CME programs with self-guided, computer-assisted learning.	computer	346 physicians	To study the relationships among key elements of selected theoretical models of adult learning applied to CME, using a descriptive survey technique and non-parametric statistical analysis.	Responses to program quality and effectiveness were high. In a three- month follow-up, almost half of the participants said they were incorporating something they had learned into their practices. Greater use of computers by those who had graduated from medical school after 1980.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Jim LK, Filibeck DJ, Gee JP, O'Bey KA, Fox JL. (1982)	Evaluation of computer-assisted, self-instructional model for pharmacy continuing education	computer	22 pharmacists	To investigate the effectiveness of a computer-assisted case-study for pharmacy continuing education.	Mean posttest score higher than mean pretest score. Two-week posttest score lower than immediate posttest score, but still significantly higher than pretest score. Half of the participants found the program easy to use. Majority found case study format of learning to be more interesting than textbook or lecture format.
Karlsson D, Ekdahl C, Wigertz O, Forsum U. (1997)	A qualitative study of clinicians ways of using a decision-support system for accessing information	computer	Six physicians working at the internal medicine department at Motala hospital	To study the way clinicians use a computerized decision-support system for accessing information.	Two main uses of the system were to get patient-specific decision support and to get CME.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Kripalani S, Cooper HP, Weinberg AD, Laufman L. (1997)	Computer-assisted self-directed learning: the future of continuing medical education	computer	350 randomly selected physicians from a database of all primary care physicians practicing in Texas who participate in full-time direct patient care.	To survey physicians' access to computers and their interest in computer-assisted CME (CACME).	Most physicians reported prior computer use and had access to a personal computer. Approximately half of physicians indicated they would be interested in CACME if they could use their existing computers. Those with computer experience gave a significantly higher rating of CACME than their counterparts with no prior experience. Overall, most of the physicians were interested in computer-based CME.
Kuramoto A. (1984)	Teleconferencing for nurses: Evaluating its effectiveness	audio & print	nurses	To develop and compare alternative methods for delivering continuing nursing education.	A statewide distribution system using three methods of course delivery was effective in terms of increasing participants' cognitive knowledge, as well as nurses' learning and satisfaction.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Kuramoto AM, Wyman JF. (1986)	Design and implementation of effective delivery approaches for continuing nursing education.	Teleconference print, lecture	nurses	The purpose of the project was to develop and compare the effectiveness of three delivery methods (a teacher "live" class; a teleconference class; and independent study packages) for delivering continuing nursing education	Independent study method was the most successful method, however had the highest attrition rate. Teleconferencing participants were more highly committed to attending class sessions than the live class participants. Learning was associated with all three delivery methods.
Landis BJ, Wainwright M. (1996)	Computer Conferencing: Communication for distance learners	computer	Pretest: 7 nurse practitioner (NP) outreach students, 12 on-campus students. Posttest: 6 NP outreach students and 9 on-campus students.	To discuss the pilot-testing of a program in which students at remote locations used computer conferencing to receive course assignments and to interact with faculty members and one another.	The technology significantly increased communication between faculty members and off-campus students. Learners completing the course were more comfortable communicating with faculty by computer, perceived less need for physical interaction with classmates and were more satisfied with faculty interaction than their on-campus counterparts.
Langille DB, Sargeant JM, Allen MJ. (1998)	Assessment of the Acceptability and Costs of Interactive Videoconferencing for Continuing Medical Education in Nova Scotia.	video-conferencing	physicians	To evaluate the acceptability of interactive videoconferencing for providing CME to Nova Scotia physicians, both rural and nonrural.	Participating physicians and faculty were enthusiastic about their involvement in CME programming. Program content was rated highly by almost all participants, and a majority felt that the format was as effective as face-to-face CME.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Latchem C, Rapley P. (1992)	Trial by satellite: Video conferencing for continuing education for rural area nurses.	video-conferencing	nurses	To evaluate the effectiveness of video conferencing technology for continuing nursing education by assessing the opinions and perceptions of rural nurse participants.	Majority of participants indicated they were satisfied or very satisfied with the quality of the picture and sound. Most learners also described the sessions as definitely or on the whole useful as continuing education programs, enjoyable, and considered teaching via this medium superior or comparable to normal lectures.
Lawson KA, Shepherd MD, Gardner VR. (1991)	Using a computer-simulation program and a traditional approach to teach pharmacy financial management	computer simulation vs traditional teaching	50 pharmacists in Texas	To evaluate instructional approaches used in teaching financial management to pharmacists in a CE seminar setting.	Analysis of pretests and posttests showed significant gains in achievement for both groups with no between-group differences. Follow-up tests were also not significantly different between the two groups. Groups did not differ in terms of attitude towards the seminar in general.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Lee W, Ault H, Kirk JS, Comstock CH. (1995)	Interactive multimedia for prenatal ultrasound training	computer	35 house-staff physicians from the William Beaumont Hospital, Michigan, between Sept 1992 and May 1994. There were 21 obstetrics and gynecology and 14 radiology physicians.	To describe the techniques, preliminary experiences and future directions related to the Fetal Imaging Workstation Demonstration Project.	During a 9 month period house-staff physicians correctly diagnosed 78 ± 4% of unknown cases. Participants found the module to be a useful training tool. A few individuals disliked multiple- choice questions (K-format) and indicated a strong desire to see more motion ultrasound video as opposed to still images.
Lejarraga H, Ageitos ML, Galli A, Castro C. (1998)	A countrywide program of continuing professional development in Argentina	print	1993 - 2641, 1994 - 2778, 1995 - 2982 and 1996 - 3653 pediatric physicians from Argentina.	To describe the introduction of a structured, distance learning program accessible to all pediatricians in Argentina.	In each of the 4 years, more than 93% of the students passed the examinations. When compared to 35 pediatricians who did not participate in the course, there was a substantial difference in favor of the students who did participate in the program.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Lockyer JM, Parboosingh IJ, McDowell AC. (1987)	Teleconferencing and the Continuing Education Preferences of Physicians and Nurses in Rural Areas.	teleconferencing	physicians and nurses	Using a questionnaire, to document user perception of teleconferencing as a method of continuing education and to determine whether the perceptions differed by attendance or the number of years that their community had participated in programming.	Teleconferencing was ranked significantly higher for usefulness by physicians from communities that had participated for four or five years when these physicians were compared to their colleagues whose communities had participated only two years.
MacKinnon III GE, Pitterle ME, Boh LE, DeMuth JE. (1992)	Computer-based patient simulations: Hospital pharmacists performance and opinions	computer	72 pharmacists	Objective of this study was to evaluate pharmacists' attitudes toward patient-simulations, measure performance, and assess possible relationships between demographic characteristics and performance.	Participants felt that the simulations adequately tested their knowledge and that they would recommend them to colleagues. Scores indicated some difficulty in gathering patient data and showed that correct therapeutic decisions may not always occur even if adequate information is obtained. Limitations of simulations include the inability to capture all possible variables and the fact that therapeutic options and practice standards are constantly changing.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Marquis Y, Chaoulli J, Bordage G, Chabot JM, LeClere H. (1984)	Patient management problems (PMPs) as a learning tool for the continuing medical education of general practitioners	print	205 out of about 4500 randomly selected physicians in the province of Quebec	To determine: 1) If successive resolution of three PMPs dealing with the same clinical topic results in progressive improvement of performance on paper. 2) If corrective feedback following each PMP will further improve performance. 3) If the knowledge acquired will be transferred to practice.	Overall there was an increase in learning (ES-scores) between the first and second mailing followed by a plateau. Groups receiving correction material showed improved performance. 75% of knowledge was transferred to practice following the project.
McAlindon MN, Smith GR. (1994)	Repurposing Videodiscs for Interactive Video Instruction: Teaching Concepts of Quality Improvement.	interactiveve videodiscs	nurses	This study was undertaken to determine the effectiveness of an IVD program for teaching registered nurses in the clinical setting the concepts of QI.	Registered nurses who used the program had a significant increase in knowledge from pre to postprogram and expressed a willingness to apply the concepts of quality improvement to their daily patient care activities.
Mottram DR, Rowe PH, Stanley IM. (1993)	An evaluation of Enpharm, a computer-assisted learning program for pharmacists	computer	100 pharmacists	The focus of this study was to evaluate the Enpharm software program for pharmacists.	Program was easy to load. Presented cases were realistic. Overall, respondents felt that Enpharm would be beneficial to other pharmacists as a means of continuing education.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Moore KHP, Brouwer KLR, Joyner PU. (1997)	Lessons gained from distance delivery of an applied pharmacokinetics course	print, videotapes and interactive videoconference	54 external doctor of pharmacy students	To describe the application and evaluation of an applied pharmacokinetics course to external doctor of pharmacy students.	Majority of respondents favored videotapes, felt that the course pack was a helpful supplement, believed interactive videoconferences were vital and that they were able to communicate between sites very well.
Nath CJ, Thomasson CL, Iverson MJ, Davis P. (1981)	The Effectiveness of Rate-Accelerated Speech in an Audio-Taped Continuing Education Program for Pharmacists.	audio cassettes	pharmacists	The purpose of this study was to determine if pharmacists who listened to compressed audio tapes at selected rates of acceleration and of varied difficulty comprehended the information and found them acceptable as a method of presenting material in continuing education programs.	Audio tapes presenting medical content of varying complexity can be accelerated to rates of 75 percent without having a significant effect on pharmacists' ability to comprehend. In addition, pharmacists were willing to accept the technique of rate-accelerated speech up to approximately a 50 percent compression rate.
Neafsey PJ. (1997)	Computer-assisted instruction for home study: A new venture for continuing education programs in nursing	computer	Twenty-seven advanced practice nurses (APNs)	To test a 5-contact hour home-study computer-assisted instructional (CAI) program in pharmacokinetics developed by the author.	Significant increase in knowledge and self-efficacy scores post home CAI. Opportunity to read, review and redo program as often as necessary was perceived as program strength. High level of learner satisfaction reported.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Neafsey PJ (1998)	Immediate and enduring changes in knowledge and self-efficacy in APNs following computer-assisted home study of the pharmacology of alcohol	computer	18 advanced practice nurses enrolled in the nurse practitioner program	To describe the development and pilot evaluation of a CAI home-study program on the pharmacology of alcohol.	Significant gains in knowledge and self-efficacy, which, at five months post, remained significantly higher than pretest. High level of learner satisfaction reported.
Ostbyte T. (1989)	An "electronic" extramural course in epidemiology and medical statistics	computer	27 participants: 18 physicians, 4 research nurses, 2 health administrators, 3 health scientists. (25 from Canada, 2 from Norway).	To discuss the insights gained from an extramural university course in epidemiology and medical statistics taught by a computer conferencing system.	Students experienced some initial technical problems. Location and time independence were perceived to be the greatest advantages. Main costs were in personnel time necessary for developing course material, testing the hardware and software, organizing classes and communicating actively with students. This cost is offset by the fact that the program can be used repeatedly.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Palmer TEA, Cumpston PHV, Ruskin K, Jones RDM. (1997)	WCALive: Broadcasting a major medical conference on the Internet	computer	200 anesthetists from around the world	To evaluate the feasibility of broadcasting continuing medical education lectures over the Internet and to evaluate user acceptability of current technology and determine areas where this must be improved by means of anecdotal reception reports.	Feedback via e-mail was overwhelmingly positive. Reception depended on the recipient's Internet connection. Those with Internet connections via domestic telephone lines and conventional modems had poorer reception.
ParryBush AM. (1993)	Computer-based training: training approach of choice	computer	1400 staff including nurses, the number of nurses was not provided	To discuss the use of computer based training (CBT) as a training approach for the ProTouch patient care software.	Survey responses overall have been positive. Modifications to the CBT have been based on both survey and alpha unit recommendations.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Pengov RE, Wright JC, Forman MH. (1979)	The use of computer-assisted instruction in the core content review for family physicians	computer	57 family physicians and residents	To offer a portion of the Core Content Review (CCR) of Family Medicine online and to assess user performance, user perception of the relative value of the CAI CCR and user attitude toward and acceptance of the CAI medium of delivery.	CAI scores were not significantly different than previous pen and paper scores. Majority ranked the CAI program as better than the pen and paper method. Participants had high level of overall satisfaction with the CAI program. Approximately half of the participants felt it would be of value to make the entire CCR available via CAI.
Petzinger Kaplan I, Radonic Pattin L, Hamilton RA. (1996)	Adaptation of different computerized methods of distance learning to an external PharmD degree program.	computer	Pharmacists enrolled in the PharmD degree program	To adapt a proven computerized method of distance learning to a college's didactic portion of the external PharmD degree program.	Students found Wildcat! easier to learn, had a more rapid response time, easier telecommunications access and fewer problems in file transferring. Using the computer programs, students developed a sense of community, which was lacking in the first course. Computer skills for both programs improved over the course of the semester.
Pill R, Stott NCH. (1988)	The Open University pack on coronary heart disease: reactions of Welsh general practitioners	print (the pack also includes audio-cassettes and a video tape)	30 GPs from all over Wales	To describe the results of an evaluation of the Open University pack on coronary heart disease.	There was a high level of awareness about the pack. However, only 17% were definitely planning to introduce the pack into their own practice.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Pogue LM. (1982)	Computer assisted instruction in the continuing education process	computer	27 newly employed nurses were randomly assigned to experimental (computer instruction) and control groups (conventional teaching).	To discuss the advantages of using the computer as a learning and teaching device in nursing education.	The adjusted scores of the total test scores of the experimental group were statistically significant. The majority of respondents stated that they would rather use a microcomputer than study from a textbook and that they understood the material better using the computer than they would have using a textbook.
Premi J, Shannon SI. (1993)	Randomized Controlled trial of a Combined Video-Workbook Educational Program for CME	videotape and workbook	physicians	To examine the effect of an innovative CME program on physician's knowledge of the diagnosis and management of patients with chest pain.	There was a significant increase in the posttest scores for those who used the program compared with the scores of those in a control group.

Author	Title	Type of Distance Education	Sample	Purpose	Findings
Price B. (1989)	Left on the shelf?	print	42 nurse teachers (survey), 14 clinical nurses (interview).	To report on a survey that was carried out to assess the extent to which distance learning packages are used.	Much material did reside "on the shelf" and the use of resources was selective and restrictive. In many cases individual exercises or items could not easily be adapted to local school or clinical circumstances. Shortage of time owing to multiple commitments conflicted with their need to review the package properly before use and to employ it in economic and sensitive ways.
Reiss J, Cameon R, Matthews D, Shenkman E. (1996)	Enhancing the Role Public Health Nurses Play in Serving Children with Special Health Needs: An Interactive Videoconference on Public Law 99-457 part H.	interactive videoconferencing	nurses	The purpose of the evaluation was to measure knowledge change and to assess the degree to which public health nurses were satisfied with the distance education format.	Results revealed a high degree of satisfaction with distance learning and no difference across sites in knowledge acquisition or participant satisfaction. A need identified through this project is increased interdisciplinary communication among health care professionals.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Rhodes Alden K, Carrozza MA. (1997)	The North Carolina AHEC Self-Paced RN Refresher Program: An evaluation of the first two years	correspondence	187 nurses who had taken or completed at least the didactic component between April 1,1990 and May 1, 1992. Also 46 questionnaire went to nurses who chose not to complete the course.	To evaluate the effectiveness of the nurse refresher program during its first two years, to describe the student population demographically and to determine the return to nursing practice of refresher nurses.	91% of nurses felt prepared to re-enter nursing practice after having completed the didactic and clinical components of the program.
Richardson ML, Norris TE. (1997)	Online delivery of continuing medical education over the World-Wide Web: an online needs assessment	computer	317 respondents (physicians, radiology technologists, physician assistants, nurse practitioners and 26 other types of medical practitioners)	To carry-out a needs assessment survey to assess the need for more online CME courses and to document those topics of most interest to the respondents.	Median number of online CME hours desired was 15. Physician responders willing to pay a median amount of $10 per credit hour. Most common suggested topic was general radiology followed by general reviews of MR imaging, CT sonography and other radiology topics.

Author	Title	Type of Distance Education	Sample	Purpose	Findings
Roberts C, Fox N. (1998)	General practitioners and the Internet: modeling a 'virtual community	computer	GP's and their colleagues contributing messages to the gp-uk list-serv from Aug 1/95 to July 31/96 were sampled.	To explore the use of the Internet-based discussion group gp-uk by GPs and their colleagues.	The list gp-uk has features of a collaborative medium, in which the audience are also contributors. There is support for a 'critical mass' model, in which a relatively small number of members contribute on a regular basis. There is little support for a 'discretionary database' model of more formal sharing of specific factual information. Neither a critical mass nor a discretionary database model captures the dynamics of a list intended for professional development.
Rosner E, Gould B, Gaschler L, Howard S, Rarick B. (1996)	Evaluation of a Satellite Educational Program. Clinical Laboratory Science	satellite videoconferencing	physicians and clinical laboratory specialists	To evaluate the effectiveness of an educational program which used a combination of live satellite programming and individualized instruction and to develop an evaluation strategy that would be useful to other educators who provide distance-based educational programs.	Study results indicated an increase in participants' knowledge of good laboratory practices and application of the practices in their laboratories. Participant satisfaction with quality of the video transmission and course objectives being met were high. Problem-solving exercises posed during the telecast demonstrated that the participants were actively involved and had completed the self-study material.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Rufo KL. (1985)	Effectiveness of self-instructional packages in staff development activities.	print	38 nurses, stratified randomization into control and experimental groups.	To discuss the challenge of developing productive & cost-effective instruction for the task of hospital orientation.	Five out of the ten educational packages showed significant learning. With some modifications, three more of the packages could also be effectively used in a self-instructed hospital orientation program.
Russin MM, Davis JH. (1990)	Continuing education electronic bulletin board system: provider readiness and interest	computer	A random sample of 225 providers of CE in Florida who were approved by the Florida Board of Nursing.	To explore the feasibility of establishing a computer-based, statewide electronic bulletin system (BBS) for continuing education for nurses in Florida.	Four of the most desired services of BBS are advertising CE for nurses, announcing CE programs, networking with other CE providers and determining the topics of interest for nurses. Two major impediments to setting up a BBS system are startup and maintenance costs and the nursing profession's lack of preparedness.
Sanborn DE, Sanborn CJ, Seibert DJ, Welsh GW, Pike HF. (1973)	Continuing Education for Nurses via Interactive Closed-Circuit Television: A Pilot Study.	closed-circuit television	nurses	A pilot study was designed to determine the acceptance of closed-circuit television as a medium of continuing education for registered nurses.	This study indicates that a closed-circuit system is amenable to learner participation and the results of attitude rating scales, preference rankings, and a questionnaire indicated that nurses who utilized the medium more frequently accepted it more than nurses who utilized it less.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Sateren SG, Boyd C. (1990)	Community hospital embraces high-tech training	interactive videodisc (IVD)	Nursing education staff, nurses, physicians and residents	To discuss the addition of an interactive videodisc system to the Mount Caramel East Hospital in Columbus.	In first four months, 350 uses of the system were logged mainly by nurses, residents and medical students rotating through the emergency department. Nurses' interest in the simulator has continued to increase. This could be explained by: the addition of a second system and/or awarding of nursing contact hours through the hospitals education department.
Savela E, Lilja J, Enlund H. (1996)	Continuing Education by Teleconference to Remote Areas.	videoconferencing	pharmacists	To evaluate the effectiveness of pharmaceutical distance education by teleconference in order to find out the suitability of the medium and to further develop this kind of education.	Communication was bi-directional enabling discussion and interaction, initial resistance to new methods of education disappeared with growing experience, respondents from the central site were more content with the lectures and video education than respondents at satellite locations, and participants at satellite locations were more satisfied with the group work.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Savela EM, Enlund HK. (1996)	Public Radio as a Means of Continuing Education in Pharmacy.	radio	pharmacists	To determine how actively pharmacists and pharmacist assistants participated in this type of education and how much it would affect cognitive knowledge about the topics.	57.8% of the respondents had listened to some of the programs. Transmission time (6 pm) was the most common complaint. Participants responded that the programs were useful and majority indicated it was desirable to arrange this kind of education in the future as well.
Tann J, Hodges M, Stewart BJ. (1992)	Evaluation of distance learning packages for residential homes and patient medication records	print	650 out of 2478 participants from the residential homes program and 650 out of 2525 from the PMR program.	To discuss the implementation and evaluation of two distance learning packages for residential homes and patient medication records.	Feedback on the course was generally positive and the majority of course participants believed that the course objective had been met. Questions that actively engaged the student (required professional judgement and/or thought) were handled better by the participants. Hands-on experience, which occurred in the workshops, was also rated favourably.
Thompson & Taylor (1991)	"Well, was it worth it?" The value of teletutorials for bachelor of nursing students	audio conference telephone tutorials	nurses	To evaluate teletutorial support for correspondence courses.	Teletutorials provided a sense of belonging to a group and a forum for discussion.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Thompson WL, Dyke JP, Buonocore E. (1996)	Using the World-Wide Web to train and certify physicians in the safe use of fluoroscopy.	computer	All physicians at the University of Tennessee Medical Center at Knoxville	To describe a practical, user-friendly, computer-driven method to teach physicians to recognize undesirable operating parameters and to predict the likelihood of skin injury in fluoroscopy.	Existing Internet connections and availability of librarian support for inexperienced users contributed to the popularity of hospital computers, whereas, convenience and confidentiality gave home computers appeal for experienced computer users. The difference in number of attempts and scores of the first attempt between groups of radiologists and non-radiologists significantly favored the radiologists.
Tinsley L, Easa D. (1986)	Pulmonary diseases in the neonate: a computer-assisted instruction program	computer	Various groups of physicians in Hawaii	To discuss the application of a continuing education program in pulmonary diseases of the neonate. The authors also give some preliminary program evaluation results.	Preliminary results of survey indicate: 1) CAI is an acceptable method of continuing medical education. 2) Some initial reluctance and avoidance by some physicians. 3) There is an objective realization that in the absence of live patients and live teachers, this method of instruction could fulfill the needs of CME.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Togno JM, Lundin R, Buckley P, Hovel J. (1996)	Rural health and IT&T in Australia - the results of qualitative and quantitative surveys of the needs, perceptions and expectations of rural and remote health professionals	telephone	medical practitioners, allied health professionals, and nurses.	To report the initial findings of qualitative and quantitative surveys of rural and remote health professionals in Australia to determine their present use of IT and tele-communications, barriers to the use of IT&T, and expected future uses.	Telephone, fax and teleconferences widely used for professional activities. Interactive satellite used extensively by medical practitioners for ongoing education. Major issues with computer use are lack of training and technical support, and lack of user friendly software. 70% consider themselves to be professionally isolated and that IT&T access would reduce this.
Treloar CJ. (1998)	Evaluation of a national and international distance education programme in clinical epidemiology	print	92 part-time on-campus students, 114 Australian DE students, 18 International DE students from a variety of medical specialties including respiratory medicine, pediatrics, geriatrics, gastroenterology, nursing, pharmacy,etc.	To describe a postgraduate clinical epidemiology course conducted by distance education for Australian and international health professionals and to compare the educational experiences of three groups of students (on-campus part-time, Australian DE and international DE).	No significant difference between completion or performance rates of student groups. Students found the course stimulating and relevant to their work. International DE students commented on the ability to receive training without leaving their families and work and the opportunity to apply their new knowledge and skill in their day-to-day work was advantageous. Students were concerned about lack of face-to-face contact with tutors.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Valish AU, Boyd NJ. (1975)	The role of computer assisted instruction in continuing education of registered nurses: An experimental study	computer	124 randomly selected nurses from the nursing staff of The George Washington University Medical Center	To discuss the use of CAI in continuing education and to determine whether CAI programs would provide a valuable resource by which registered nurses could verify and augment prior clinical knowledge in nursing.	There was no significant difference in performance between RNs who used the CAI program and those in the control groups. However, a large majority indicated that the computer experience was valuable.
Viverais-Dresler G, Kutschke M. (1992)	RN students' satisfaction with clinical teaching in a distance education program	television	nurses	To investigate student satisfaction with clinical courses by distance education.	Satisfaction with the clinical teacher's role was high; both quantitative and qualitative data indicate respondents felt a positive and supportive relationship with the clinical teacher.
Wedge KS. (1994)	HyperDesigning: An instructional design model applied to the development of a HyperCard computer assisted instruction on intramuscular injection sites	computer	Pilot- 25 BN students	To outline the development of a faculty-designed software program using the Seeles and Glasgow model of instructional design.	The program was rated as creative, useful (functional) and comfortable (users experienced minimal anxiety when using the program).

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Whiteman J, Scott EM, McElnay JC. (1994)	Analysis of pharmacists attitudes toward a distance learning initiative on health screening	print	Group 1: 117 received part one but did not request part two. Group 2: 1487 received part one and requested part two. Group 3: 520 completed entire course.	To determine community pharmacists' attitudes to distance learning in general and to the "Health Screening for Health Promotion" distance learning course in particular. To assess the influence of certain characteristics upon pharmacists involvement in distance learning.	Significantly higher percentage of females versus males requested and completed the course. 80% of Group 3 respondents believed that DL was more suitable for them than other CE methods. Approximately 74% of group 3 (completing) pharmacists already provided or intended to provide, screening services. Significant improvement in the score for the statement "this method of learning was enjoyable" after completion of the course, compared with before studying part two.

Author	Title	Type of Distance Education	Sample	Purpose	Findings
Whitten P, Ford DJ, Davis N, Speicher R, Collins B. (1998)	Comparison of Face-to-Face verus Interactive Video Continuing Medical Education Delivery Modalities	videoconferencing (ITV)	physicians and nurses	To explore the effectiveness of ITV for CME by comparing it to traditional, face-to-face delivery of CME	Participants in ITV programming indicated positive perceptions of the ITV medium, comfort in receiving CME through ITV, convenience ITV offers through access without the need to travel, effectiveness of ITV in terms of similarities to a speaker actually being in the room, and a willingness to obtain future CME credit via ITV. Study substantiated claims from rural physicians that ITV is an important tool enabling them to participate in timely and relevant educational activities
Wieczorek RR, Price MR, Cannon C. (1998)	A pharmacology review for private duty nurses using computers and self-learning concepts	computer	124 nurses	To discuss the application of a computerized self-learning program offered to nurses who were required to take a National League of Nurses (NLN) pharmacology examination.	110 nurses successfully passed the NLN exam after completing the computerized self-learning package.

Author	**Title**	**Type of Distance Education**	**Sample**	**Purpose**	**Findings**
Wilson AL, Wellman LR, Fenton LJ, Witzke D. (1982)	Development of a correspondence CME course for rural physicians	Print	359 physicians	The authors describe how a CME course in South Dakota was administered and they evaluate its effectiveness.	Responding physicians found the program helpful and would take another course with a similar format. Over two-thirds of those who responded indicated that the course would alter how they counselled patients.

Appendix B
Print and Correspondence Abstracts and Study Summaries

Print and Correspondence Abstracts and Study Summaries

Abbey J. Distance education: an option for gerontic nurses. The Australian Journal of Advanced Nursing 1987; 4(3): 4-11.
Abstract: The rapid ageing of the Australian population has created an urgent need for more qualified gerontic nurse practitioners. After surveying available staff resources and likely future nursing requirements, the south Australian Health Commission chose to meet this need by fostering a distance learning approach to the education of post-basic students. This paper describes the advantages of offering distance education using an adult learning model to nurses working in aged care, as well as development of a pilot program in gerontic nursing, its implementation and evaluation and changes arising from the evaluation.

Anderson R, Dickson A, Lee S. Clinical staff development: a two-way solution. Nursing Times 1997; 93(5): 36-38.
Abstract: This paper explains how a trust worked with a higher education institution to provide continuing education for clinical staff. The result was a staff development award that carries 60 CATS points at level 2. Evaluation shows that the award has not only helped staff in their practice but has also been cost-effective. In addition there have been benefits in terms of professional development for staff involved in running the program.

Anon. Developing a structured distance-learning program. Irish Pharmaceutical Union Review 1987; 12: 291-293.
Summary: The voluntary participation of Australian pharmacists in formal continuing education has been historically poor. The main reason given by practitioners is that the programs are not relevant to their needs. Because of mandatory continuing education, more individual pharmacists have begun to further their professional updating. The author suggests two important considerations that apply to any continuing education material: 1) professional education is basically to maintain an appropriate level of practice performance and not just to provide interesting information and; 2) knowledge gained has to be effectively applied to meet the individual needs of individual patients if adequate practice is to be maintained. The author goes on to discuss the development of a continuing education program by the Pharmaceutical Society of Australia, dealing with improving the quality of pharmaceutical service available to the community.

Antunano MJ. Use of advanced technology in distance education. Aviation, Space, and Environmental Medicine 1993; 64: 86-7.

Summary: In this paper, the author discusses the renewed interest in distance education and also the new technologies available in distance learning. The FAA has renewed interest in distance education because it involves providing cost-efficient quality education to increasing numbers of students, recent high quality programs resulted in quality training outcomes, and the availability of new communications and technologies that will make distance learning cheaper than before. The author identifies the media available for continuing education including audio, still visual, motion visual, physical objects, computer technology, optical disc technology and teleconferencing, providing a brief description of each.

Bassett CC. Open learning in palliative care. European Journal of Cancer 1994; 3: 118-121.
Abstract: Open learning is increasing in importance in nurse education. In this article the author considers open learning and discusses its use in palliative care education. Advantages and disadvantages of this learning method are considered and guidelines are offered to the teacher to assist them in evaluating existing learning packages or to produce their own open learning materials.

Beaton GR. Continuing education of health workers in rural areas. South African Medical Journal 1977; Feb: 201-202.
Abstract: The need for effective continuing educational programs for all health workers in rural areas is discussed, with particular mention of the role of a doctor as a teacher. Various approaches to continuing education are described.

Beresford R. Distance learning: Experience in New Zealand. International Pharmacy Journal 1998; 12(1): 12-13.
Summary: In this paper the author provides a brief introduction to distance learning, how it has been incorporated into open universities, and the benefits of such a program in New Zealand. The correspondence schools in New Zealand commonly use written materials accompanied by audio and videotapes, radio programs and telephone conferencing. This method of education allows the courses to be available to a wide range of professionals who would otherwise be too busy to attend. In this paper the author describes a program available through the University of Otago, School of Pharmacy that began as a Master's degree for hospital pharmacists but it has expanded quickly to community pharmacists. This type of learning allows the students to work at their own pace most of the time, but the use of audio-conferencing does add some restrictions.

Birks M. Going the distance. Australian Nursing Journal 1997; 5(5): 27.
Summary: Distance learning is increasingly becoming the preferred option for the continuing education of nurses. This method of study offers a flexible, economic and accessible means of updating nurses who often have only very limited time for learning. For many, distance learning suits their lifestyle and their style of learning. The major drawbacks of distance learning are the lack of student support and the considerable discipline necessary to perform assigned tasks and meet deadlines.

Boswell EJ, Lorenz RA, Pichert JW, Schlundt DG, Penha MLI. Evaluation of a home study continuing education program on patient teaching skills. Journal of Continuing Education in the Health Professions 1994; 14(3): 155-165.
Abstract: We developed a home study version of an established and successful workshop program called Effective Patient Teaching (EPT), making use of suggested guidelines for developing home study courses. The self-study modules we produced consisted of workbook materials, videotape illustrations and practice exercises, all of which focused on patient teaching and counseling skills. During a period of 2 years and three months, 28 participants enrolled in the home study course. Only one participant completed the entire course. Another participant completed the portion purchased. The barrier most commonly cited as preventing completion of the home study course was other work-related deadlines. We suspect that our requirement for a feedback procedure (either an audio- or a videotape of an interview) may also have prevented submission of a completed course. The low completion rate made quantitative evaluations impossible. Although the literature includes reported successes in the use of self-learning courses, few formal evaluations have been conducted and reported. The efficacy of home study courses, particularly when enhanced skill is the desired outcome rather than knowledge gain, is yet to be established and merits close examination and rigorous evaluations.

Bottomly MB. Distance learning in sport and exercise medicine. British Journal of Sports Medicine 1997; 31: 2-4.
Summary: In this article the author describes the benefits of distance learning. The advantages of this type of learning include: the formative assessment (How am I doing?) provided by the workbook, audio-tape and videotape design, as well as the traditional summative assessment in the form of examination or test followed by constructive feedback from the module tutor. Formative assessment allows students to evaluate their knowledge, practice their skills and consolidate their learning in a non-stressful and non-judgmental way. Students can fit the course to their own pattern of learning. The interactive nature of the material encourages self-

development rather than just training. One problem is that students can feel isolated thus, it is important to have a good tutor support system. The author states that public demand and government initiatives are placing an increased demand on doctors to be aware and informed of sports medicine and distance learning is an effective way of accomplishing this goal.

Burley S, Teasdale K. Open learning for enrolled nurses. Nurse Education Today 1991; 11: 394-397.
Abstract: Enrolled nurses need help in considering the new range of career options which conversion courses have opened to them. They also need assistance in planning how best to take advantage of these new opportunities. This article describes a training course run in South Lincolnshire which aims to help enrolled nurses to meet their development needs through a combination of classroom and distance learning methods.

Cochrane J. Distance learning courses at the Royal College of Surgeons. British Journal of Hospital Medicine 1997; 57(6): 270-271.
Summary: In this report the author discusses the development and implementation of the STEP course (Surgeons in Training Education Program). The STEP course is a 20-month distance learning course that "seeks to cover all the theoretical knowledge in the examination syllabus, which is now common to all four Royal Colleges." The course involves a workbook, which directs reading from textbooks and review articles. The workbook also tests knowledge with case histories, questions, and exercises. A written examination is taken at the end of the 20-months. Students find support from other students and from surgical tutors during meetings that may be held up to three times a week. Surgeons who have enrolled in the course so far have been enthusiastic.

Conrad B, Price P. The Adult Critical Care Nursing (ACCN) Post-Basic Distance Education Program: Flexibility in learning. AARN 1993; 49(2): 19-21.
Summary: In this report the authors discuss the need for and development of a distance education program in adult critical care nursing. A needs survey was conducted of 144 graduate nurses and 63% indicated a strong interest in such a course. The ACCN distance program was developed as a pilot project and implemented over a two-year period. The goals of the program were to: be accessible to as many Alberta nurses as possible; incorporate maximum flexibility so that prior work and education experiences as well as future career goals of students were recognized; recognize the unique life circumstances and learning styles of students;

provide the necessary structure to allow certain degree of flexibility, yet guide a student through to successful completion; offer the communication and support systems to assist the student through the learning process. In terms of flexibility, the program should allow the student to enter and exit at several points along the program path, make choices with respect to the order the program material is covered, provide challenge assignments and/or courses for credit and selected course options.

Cook H. Task based learning – the results of a pilot study. The Pharmaceutical Journal 1993; 251: 93-95.
Abstract: The results of a pilot study that was carried out to assess the use of task-based learning, as part of a larger continuing education module on asthma for community pharmacists are presented. The task involved each pharmacist talking to five asthma patients about their inhalers, following questions set out on an assessment form. Feedback from the 12 participating pharmacists on the use of the task as a learning tool was positive. The pharmacists felt that the task had enabled them to put knowledge obtained in the distance learning section of the module into practice.

Cook L. Moving mountains. Nursing Standard 1997; 12(12): 26-27.
Summary: Accessing continuing professional development can be a huge problem for nurses who live in remote places. The author describes how the problem was tackled for community nurses in Scotland's remote islands. The feedback from the course was positive and it indicated that this group were highly motivated and perceived the workshop as beneficial to the local implementation of a clinical support system and to their practice as a whole. The author also noted that given the cost of an average conference, specialized targeted workshops are a much better value.

Cronenwett LR. Effective methods for disseminating research findings to nurses in practice. Nursing Clinics of North America 1995; 3: 429-438.
Summary: Professionals in all disciplines are challenged by the proliferation of new knowledge. Nurses, too, must find cost-effective ways of ensuring that their patients are benefiting from the most current knowledge about health and illness. The methods of research dissemination to clinicians described in this article are presumed to be effective because of anecdotal reports, conference evaluations, or clinician surveys. The profession needs more sophisticated evaluations of the effectiveness of various dissemination methods.

DeMuth JE, Weinswig MH. Learners' evaluations of an accredited continuing education course in a pharmacy journal. MOBIUS 1984; 4(2): 12-19.
Abstract: Two studies were conducted of pharmacists who successfully completed an accredited continuing education course available through a major professional journal. Data were collected regarding the learners' evaluations of the accessibility and effectiveness of this method of home study. This article reports on the findings of the second study and compares the data with the original work. Results indicated that this particular journal course was valuable to practitioners and of utility in their interactions with other health professionals and patients. Because of the flexible nature of this self-paced means of learning, it was found equally acceptable to a wide range of pharmacists, regardless of their age or practice setting. All aspects of the course received positive evaluations by learners, with convenience of this method appearing to be the most important feature. Motivation prompting the pharmacists to enroll and their decision to re-enroll in the course had the greatest influence on their evaluations of the course.

De Muth JE, Weinswig MH, Van Fleet JS. Evaluation of journal readings as a method of pharmacy continuing education. American Journal of Pharmaceutical Education 1983; 47: 252-256.
Abstract: Accredited journal courses represent a new innovation of one of the oldest and more commonly used methods of learning. A study was conducted to determine the acceptability and effectiveness of one such course approved for mandatory continuing education requirements. It involved pharmacists completing at least one year of course work. The particular program studied proved to be a very satisfactory method of independent study, offering valuable and practical information. The course was equally acceptable to all pharmacists regardless of practice setting, experience or licensure in states with mandatory requirements. As expected, the primary motive for enrolling in this type of independent study was fulfilment of mandatory requirements. Most of the pharmacists would recommend the course to a colleague and the majority were still enrolled three years after the study. Cognitive testing showed that respondents performed significantly better in those areas for which they had studied and received credit. Based on the study, no changes were made in the contents or format of the journal course.

Docking S. Professional development through distance learning. The Professional Nurse Accredited Learning Scheme. Professional Nurse 1993; 9(1): 38, 40-1.
Abstract: Professional Nurse and Thames Valley University are delighted to announce the launch of the Professional Nurse Accredited Learning Scheme – a joint initiative to enable readers to gain credits for their academic study programs. This

article outlines the first module in the program, which can be used to gain points toward a diploma in higher education or simply to fulfill PREP requirements. Each module in the scheme is presented in four parts over four months. The program offers flexible access to higher education.

Dutta PK. Role of distance learning in health manpower training. Indian Journal of Public Health 1995; 39(1): 16-19.

Summary: In order to meet the challenges of training health workers at various levels, there is a requirement to have involvement from a variety of disciplines in both design and delivery. Distance education can meet the need for training of medical and para-medical personnel by utilizing a variety of educational technologies. This article describes the process which was involved for developing an interdisciplinary distance learning program for remote health care providers.

Dutta PK. Continuing medical education of general practitioners on MCH care through distance learning. Indian Journal of Public Health 1996; 39(3): 68-70.

Summary: In this paper the author briefly describes the planning and development of the Diploma in Maternal and Child Health offered by the Indira Gandhi National Open University (IGNOU). This distance learning course was designed to meet the needs of physicians who were very busy in their daily professional activities and did not have the time nor the opportunity to undergo formal continuing education. In India, women of childbearing age and children under 15 years make up about 62 percent of the population. They also constitute a special risk group. Thus, refresher courses including new available knowledge and practices are necessary to properly manage this patient population. The distance learning course developed by IGNOU provides an accessible and flexible means for addressing the lack of continued training in this area. The author discusses the development of the program including the professional team required to develop and implement the program, the inclusion of a work center and skill development center, and the type of evaluation that should be included in the course.

Evans CE, Haynes RB, Birkett NJ, Gilbert JR,Taylor DW,Sackett DL, Johnston ME, Hewson SA. Does a mailed continuing education program improve physician performance? Results of a randomized trial in antihypertensive care. JAMA 1986; 255(4): 501-504.

Abstract: Evidence is sparse concerning the value of the "educational" materials that physicians receive in the mail. We conducted a randomized trial of a mailed continuing education program on hypertension for primary care physicians. Although formal pretesting documented that the program led to significant improvements in physician knowledge over the short term, the current study showed no lasting effect on physician knowledge (means scores on an end-of-study questionnaire were 50% and 52% for study and control physicians respectively) and no influence on performance in lowering the blood pressures of patients referred from screening (mean blood pressure drop for study patients, 12.2/10.4 mm Hg vs 13.0/10.6 mm Hg for control patients). The chance that we missed a difference in diastolic blood pressure as great as 3mm Hg is less than 5%. Resources spent on instructional materials mailed to physicians may be wasted.

Fiene MA, Fannon M, Drewry S, Spahn MA. Development of professional competence via self-instructional units. Journal of Allied Health 1984; 13(2): 124-9.
Abstract: In recent years, self-instructional teaching methods have come under criticism from educators, much of it warranted. But when self-instructional materials are written by experienced educators who teach the topic and are developed within a versatile process using a proven format, they are extremely valuable teaching aids. We discuss here the results of a grant project funded by W. K. Kellogg Foundation and describe the process used at Kettering Medical Center's School of Medical Technology to develop and produce over 100 self-instructional units. We also discuss potential uses of self-instructional units in professional continuing education programs and suggest ways self-instructional units might be used to promote interdisciplinary health care and expansion of professional knowledge banks. This project confirmed that professions can create their own educational materials through independent efforts of their members.

Francke DE. An open university for continuing education. Drug Intelligence and Clinical Pharmacy 1973; 7(Dec): 539.
Summary: The purpose of this editorial is to propose the application of an "Open University" concept to professional advancement in pharmacy. An "Open University" program is one that provides a degree program utilizing a combination of courses presented by videotape or television, independent self-study courses such as those offered by extension divisions of universities and by the more traditional classroom models. The programs should be tailored to the individual needs of participants and would be monitored by a clinical faculty advisor.

Friesen AJD, Zinyk DE, Mah G. Mandatory continuing pharmacy education in Alberta, Canada: the response to live programs and correspondence courses. American Journal of Pharmaceutical Education 1985; 49: 156-159.
Abstract: This report briefly describes mandatory continuing pharmacy education in Alberta and provides survey data to determine the response of pharmacists to the program. The survey results indicate that most pharmacists exceeded the required

number of education units and that more than 70% of the total acquired were obtained by completing correspondence programs. Females, those under 40 years of age and retail staff preferred correspondence programs. Managers, hospital staff and those over 40 years of age took somewhat fewer education units by correspondence, but attended more live programs than the former group. The popularity of correspondence is presumably due to the fact that most were provided free and because they are a more convenient method of obtaining education units. The freedom allowed to design their own educational program (choosing which CE courses they are interested in to fulfill their CE obligation) plus the modest costs involved are probably the two main reasons for the acceptability of Alberta's continuing education program to pharmacists.

Harden RM. What is ... distance learning? Medical teacher 1988; 10(2): 139-145.
Summary: In this report the author provides a brief description of distance learning and how it applies to medical education. Four main features of distance learning are listed: teacher is separated geographically from the student; learning program is planned and the student is provided with advice and assistance as to how he can best tackle the subject; the work is done by the student, and it is reviewed by the teacher; the learner usually works on his own. Occasionally small groups of doctors tackle the program as a group. The author goes on to discuss the role of the teacher as a manager of the student's learning and a producer of learning resource material and assessment material. An example of a distance learning program offered by the Royal College of General Practitioners called the CASE program (Clinical Assessment for Systematic Education) consists of patient management problems which are designed to keep general practitioners up-to-date with information relevant to their day-to-day practice. The final topic of this paper is a brief description of the types of media that are available to be used in distance education including: television, audio-tape, computers and interactive video disc, and the types of distribution (post, by hand, radio and television broadcast and telephone).

Hill P, Alexander T. Continuing professional education: A challenge for rural health practitioners. Australian Journal of Rural Health 1996; 4: 275-279.
Abstract: Health professionals in rural and remote areas of Australia are disadvantaged when accessing continuing education. Their geographical isolation influences attendance at seminars, workshops and even informal discussions with colleagues. This paper describes the strategies adopted to meet the continuing education needs of a group of health professionals working in diabetes education and discusses how other specialist areas can provide similar educational opportunities. The education programs for isolated health professionals involved in diabetes care in

South Australia were created by a team and the resources of their associated institutions. Formal working agreements were established to achieve the aim of relevant continuing education for rural health professionals and to ensure ongoing ventures. All programs have been positively received and evaluations identify the need to develop other, related subjects. Future developments will further utilize advances in technology to extend access and add to the current modes of education delivery. It is the intention of this group to continue to develop practice-based subjects capable of meeting rural health practitioners' needs and thus enhance the quality of care in rural and remote communities.

Hoskins G, Neville RG, Smith B, Clark RA. Does participation in distance learning and audit improve the care of patients with acute asthma attacks? Health Bulletin 1997; 55(3): 150-155.
Summary: The purpose of this study was to test whether general practitioners who completed an audit cycle encompassing a data recording exercise, distance learning program and personalized feedback changed their management of patients with acute asthma attacks. Practice and patient details from two national correspondence surveys of the management of acute asthma attacks in the United Kingdom in 1991-92 and 1992-93 were compared. Main outcome measures were use of nebulised bronchodilators, systematic steroids during an asthma attack, and increased use of prophylactic therapy after attacks. Ninety-one general practitioners completed an audit cycle and reported data on 782 patients with asthma attacks in 1991-92 and 669 in 1992-93. There were no significant changes in practice resources during this time. Management changed in line with recommended guidelines and audit feedback suggestions leading to more use of nebulised bronchodilators, systemic steroids and step-up in preventative therapy. General practitioners who completed an audit cycle showed changes in the management of acute asthma attacks in line with guidelines which may have been caused by participation in distance learning and clinical audit. However, general practitioners motivated to change clinical management may be similarly motivated to take part in an audit. Audit may be the catalyst for change rather than the cause of change.

Jones T, Thornton RN. Reaching remote area nurses. The Australian Nurse Journal 1986; 16(1): 51, 60.
Summary: In this paper the author discusses a refresher course in pharmacology for nurses offered by the Outreach Nursing Education Service (ONES). Course booklets were designed providing more than just the minimum information necessary to complete the course, which has resulted in the booklet being used as a reference source. The materials are forwarded to the students via mail. Each section is

followed by an examination and a trial examination (for self-assessment) is provided with the answers in a sealed envelope. An introduction session and BBQ are held to provide a chance for learners and facilitators to meet and discuss the course.

Lejarraga H, Ageitos ML, Galli A, Castro C. A countrywide program of continuing professional development in Argentina. Archives of Disease in Childhood 1998; 78: 562-566.
Abstract: The Argentinean Society of Pediatrics introduced in 1993 a continuing professional development (CPD) program to raise standards of clinical practice. The aims of the project were to introduce a structured, distance learning program accessible to all pediatricians in the country, but especially for those working far from centers of pediatric excellence. The program is planned on an annual basis. It includes four activities: a written manual designed by a team of medical experts and educationalists comprising 12 topics; field work for participants; annual meetings in several locations in the country for discussion of the subjects; and an evaluation based on centrally designed multiple choice questions distributed by mail. In spite of a registration free of 90 pounds a year, participation in the program increased from 3357 in 1993 to 4126 in 1996, from a membership of 10 216 pediatricians in Argentina. The popularity of the program may result from an appropriate interpretation of the professional needs of pediatricians in Argentina, adequate organizational arrangements that reach all colleagues, including those working in remote areas and a genuine motivation of pediatricians for participating in a learning process.

Marquis Y, Chaoulli G, Bordage G, Chabot JM, Leclere H. Patient-management problems as a learning tool for the continuing medical education of general practitioners. Medical Education 1984; 18: 117-124.
Summary: The value of Patient-Management Problems (PMPs) as a learning tool for continuing medical education was studied by using two frequently seen cardiovascular problems (angina and high blood pressure) and a province wide sample of full-time general practitioners. The results indicate that PMPs can be a motivating and effective means of CME for the general practitioner; that knowledge was gained through successive resolution of three PMPs; that corrective feedback enhanced learning; and, that most of the knowledge gained on the paper cases was transferred to practice as reported by the participants on a questionnaire. Furthermore, while cueing may be a confounding factor when PMPs are used for evaluation purposes, it was shown to facilitate learning in the present learning context.

Martin PJ. Professional updating through open learning as a method of reducing errors in the administration of medicines. Journal of Nursing Management 1994; 2: 209-212.
Abstract: Errors in administration of medicines can have repercussions for the patient, the nurse and the organization. Reducing the incidence of drug administration errors must be a constant endeavour on the part of nurses and the organization as a whole. The organization can be proactive in providing support for the nurse before errors occur through refresher courses, however, the cost-effectiveness of such courses should be considered. Traditional teacher-centred approaches may not encourage nurses to reflect upon their own practice and may only entail attendance rather than participation at a study session. An approach to drugs administration update is proposed which employs an open learning format. Consideration of the mechanisms for preparing, disseminating and evaluating such programmes are provided. Quantitative data to support positive evaluation of the update programme is not yet available. Qualitative evaluation by staff who have undertaken the module is very favourable. Staff have indicated that they have been enabled to reflect on their own performance, at their own pace and that they have enjoyed active participation in the learning process. The possible future and potential benefits, of such programmes in a time of scarce resources is discussed.

Matchett JA. Continuing education via the packaged program. American Journal of Pharmaceutical Education 1978; 42: 383-385.
Summary: This article was written to compare and discuss some of the advantages and disadvantages of various packaged continuing education programs including print, video and audio. With regards to print methods of continuing education the following advantages were mentioned: more convenient, can be used anywhere without requiring a mechanical device, can be started and stopped anytime, economical to produce, requires activity by learner (reading) which leads to an enhancement of the learning process, consistent and reproducible and does not vary in quality each time it is presented, and finally the personal evaluation of correspondence courses is much less threatening than the evaluation of live seminars. The main disadvantages of print correspondence courses are having to rely on the mail system, the need for self-discipline, and the absence of an instructor or presenter for direct feedback and immediate answers to questions.

McAnulty L. The Diploma in Professional Studies in Midwifery/Advanced Diploma in Midwifery by Distance Learning. Midwives Chronicle 1992; 105(1254): 200-2.
Summary: The purpose of this article is to discuss the progress of the DPSM/ADM program with regards to the development and implementation of the course. Forty-three students will be awarded the DPSM/ADM later this year. Success rates for

assignments for this group have ranged from 72-95%. The philosophy of the course is based on the concept of the midwife as an expert reflective practitioner, engaging in her practice a spirit of critical inquiry, analysis and evaluation. The author goes on to discuss further uses of course materials (as a refresher course), student support, managerial support, recruitment and selection of students, course evaluation and the distance learning team.

Meagan G. Distance learning: moving closer to nurses' needs. The World of Irish Nursing 1995; 3(2): 14-5.
Summary: In this paper, the author discusses the development and application of a continuing education course in management for nurses. The goal of this project was to develop a program that would allow nurses to develop their skills at home. One of the major problems is the attitude of employers to nurses gaining further education. Distance learning helps to change this attitude by allowing learning without the need for relief staff. Another problem confronting nurses is that many current courses available for distance learning have an emphasis on theory rather than practice. This course was designed to allow individuals to work at their own pace and it also provided support in the form of tutorials and workshops. The program lasts 10 months.

Ndeki SS, Towle A, Engel CE, Parry EHO. Doctors' continuing education in Tanzania: distance learning. World Health Forum 1995; 16: 59-65.
Abstract: A distance learning program for medical officers and their assistants at the district level has produced some valuable lessons for future activities in continuing education. Besides correspondence and study materials, face-to-face contact between students and their tutors is a particularly important ingredient, as it provides the guidance, flexibility and motivation that are essential for an effective program.

O'Dochartaigh E. Continuing education for doctors in rural areas. Journal of the Irish Medical Association 1971; 64(420): 484-486.
Summary: Rural physicians have minimal opportunity to meet, discuss and interact with peers and the cost to leave practice to attend a course is very high (travel cost and lack of locum availability). The purpose of this editorial is to discuss the continuing education problems of doctors in rural areas and to describe methods of distance learning which are relevant to needs and which encourage active participation by the doctor in his/her education. An important step in CE is to encourage practitioners to look at the work they do and the educational deficits in

relation to this work. The author suggests the use of Journal Clubs, including neighboring doctors and their district nurses.

Pattison S, Heller T, Baines S. 1993. Reducing the risk of cancers. A distance learning resource for cancer prevention throughout the EC. European Journal of Cancer 1993; 29A(11): 1643-1647.
Abstract: This paper describes an initiative in distance learning for cancer prevention for health care professionals throughout the EC. 'Reducing the Risk of Cancers' is a multi-media integrated study pack of learning materials prepared by the Open University (U.K.) with funding from the Europe Against Cancer programme of the European Commission. The teaching materials aim to enhance cancer prevention and health promotion skills and competencies amongst health care professionals at local level. In the paper the background to the pack is considered, the production process is described and the aims and philosophy of the teaching materials are outlined. The content of the pack is described and usage, dissemination, and evaluation for health professionals throughout Europe are discussed.

Penney NE, Gibbons B, Bushy A. Partners in distance learning: Project outreach. Journal of Nursing Administration 1996; 26(7/8): 27-36.
Abstract: Distance learning refers to any educational experience in which the instructor (teacher) is separated from the student (learner) by geographic distance. Partnerships are being established between institutions of higher education and healthcare organizations to achieve a mutual goal, that of educating employees to work in a rapidly changing workplace environment. The authors describe one such partnership and the common issues confronted by both the academic and service institutions in implementing an outreach education program. The authors propose that these partnerships can be effective in implementing distance learning programs that meet the ongoing educational needs of nurses living and working in rural and underserved environments.

Pill R, Stott NCH. The Open University pack on coronary heart disease: reactions of Welsh general practitioners. Medical Education 1988; 22: 543-549.
Abstract: The introduction of the new Open University distance learning pack on coronary heart disease to a selected group of Welsh general practitioners has been evaluated. The most commonly perceived disadvantages were the amount of time required to study the pack, the cost of buying it, and the work involved in implementing its study in a practice by the whole primary-care team. Despite a relatively high level of awareness among the group, only 17% declared a positive

intention to introduce the pack and another 17% thought they 'probably' would. Contact with primary care facilitators and informal feedback from colleagues appeared to distinguish those general practitioners who were motivated to try innovative postgraduate learning methods in their practices from the rest of the sample. The implications of trying to disseminate novel kinds of teaching material to general practitioners are considered.

Price B. Education for nurses working abroad. Professional Nurse 1995; 10(11): 725-727.
Summary: In this article the author outlines how UK nurses working abroad can update themselves professionally and how nurses from other countries can gain post-basic qualifications before working in the UK. The author states that nurses studying abroad will require considerable support; individual, group and/or removed (communicating with a tutor via fax, telephone, letters, etc.). The author also provides some matters to consider when planning distance learning abroad.

Price B. The right questions to assess materials. Selecting distance learning material. Professional Nurse 1995; 10(5): 328-30.
Summary: PREP's implementation makes nurses responsible for their continuing professional education, but it is becoming increasingly difficult to gain sponsorship or time off from employers. Distance learning can solve many problems nurses' face in keeping up-to-date, but it is important to select appropriate materials. This article looks at questions potential students should ask about a distance learning program before they sign up. These questions include: Will I be able to use this mode of study successfully? How can I be sure the materials are good quality? Does the material address my area of practice? Does the program offer me support? What form does assessment take? What do I get for the money? Distance learning is a very appropriate method of continuing education for nurses who have many clinical, personal and professional commitments. The author suggests that seeking information about content, support and assessment should be the starting point for any nurse considering this form of learning.

Price B. Left on the shelf? Nursing Times 1989; 85(19): 71-73.
Summary: In this article, the author reports on a small survey that was carried out to determine the extent to which distance learning packages are used. A postal survey was sent out to 42 nurse teachers and a further 14 clinical nurses were interviewed.

The postal survey resulted in 23 responses and these were considered with the interview data. The results indicate that many distance learning packages do remain "on the shelf" and the use of the resources was selective and sometimes rather restrictive. Various reasons for the lack of use were mentioned including: the individual exercises or items could not easily be adapted to local school or clinical circumstances and that the tone of the material did not marry well with their own teaching style. Another common problem mentioned was that these educators simply did not have time to properly review the material in order to employ it in economic and sensitive ways.

Reilly CE. A satisfaction survey on distance education: A model for educating nurses in the cognitive treatment of patients with addictive disorders. Journal of Psychosocial Nursing 1998; 36(7): 38-41.
Summary: Substance abuse is very prevalent in today's society yet, very few nurses and other front line health care professionals receive any special training in this area. Continuing education through distance learning can provide a cost-effective, flexible means of updating nurses in specialized topics such as substance abuse. In this paper the author discusses the application and participant evaluation of a course involving the cognitive treatment of patients with addictive disorders. Only 18 of 78 nurses completing the course returned the survey. One-third reported that the course decreased their judgmental attitude about patients with substance abuse. All respondents indicated that they would recommend the course to a fellow colleague.

Rao VH. Correspondence Certificate Course by the IMACGP. Journal of the Indian Medical Association 1997, 95(4): 118-9.
Summary: This paper is a letter written by Dr. Rao to the Journal of the Indian Medical Association in which he welcomes the IMACGP initiation of correspondence certificate courses. He states that front-line physicians must follow the "learning while earning" principle and therefore, require more convenient and available forms of continuing medical education.

Rhodes Alden KA, Carrozza MA. The North Carolina AHEC Self-Paced RN Refresher Program: an evaluation of the first two years 1997; 28(1): 14-19.
Abstract: The North Carolina Area Health Education Centers (AHEC) Self-paced RN Refresher Program was designed to promote reentry into practice for inactive nurses. The program consists of a didactic self-study correspondence course and a clinical practicum whereby the refresher nurse works one-on-one with a nurse preceptor. At the end of the first two years, the program was evaluated to determine

its effectiveness in terms of participant satisfaction, return to nursing practice, and to describe the nurse refresher population demographically. Participants reported a high degree of satisfaction, 69% of the nurses who completed the program returned to nursing practice. The typical refresher student is a female Caucasian in her forties, married and graduated from a diploma nursing program.

Robinson D, Gajos M, Whyte L. Evidence-based care through clinical practice. Nursing Standard 1997; 11(30): 32-33.
Abstract: This article describes how a working group examined ways to overcome difficulties with applying research findings to clinical practice. The group developed a ward-based distance learning package to assist in developing staff skills and ultimately enhance patient health care. The package has implications for all registered nurses in all nursing contexts.

Robinson K. Initiatives in distance learning for nurses. Nurse Education Today 1984; 4(5): 100-3.
Summary: The focus of this paper is to discuss the background and rationale for distance learning in nurse education and to provide an introduction to DL courses that are now being made available to nurses. The main themes of the paper concern the increased access to courses due to distance learning techniques, course content and tutorial support and counseling. The authors feel that an effective distance learning program should include the following structure: a pool of readily available nurse educators for writing, consultation, discussion and monitoring of standards; a system of production and distribution which can deal with the large-scale provision of complex written and audio-visual materials; a sophisticated administrative system which can handle, for example, the recording of student details; and, a network of contracts linking the authors and tutors with the students and potential students and purchasers. These four components are discussed in more detail in the paper.

Robinson K. What is distance learning? Nursing Times 1986; 82(16): 64.
Abstract: Never before has it been so important to maintain and develop professional skills. In parts of the United States, nurses must show that they have kept up to date if they wish to continue to practice and similar arrangements could be on the way in this country. Nursing Times and the Distance Learning Center of the Polytechnic of the South Bank have joined forces to produce the first in a new pull-out introductory learning series, which can be tackled in the bath, on the bus, or during coffee break. In this article Kate Robinson explains how distance learning works and why it is so important for nursing practice.

Rufo KL. Effectiveness of self-instructional packages in staff development activities. The Journal of Continuing Education in Nursing 1985; 16(3): 80-84.
Abstract: Developing productive, cost-effective instruction for hospital orientation is examined. Ten self-instructional packages used in orientation were tested to determine if learning gained from self-instruction and from lectures and/or demonstrations were equal. Detailed description of the interpretation of statistical data, differences in learning and advantages and disadvantages are presented to encourage nurses to examine how research can effect practice.

Singh T, Natu MV. Distance education for better health care. Indian Pediatrics 1997; 34: 773-777.
Summary: Open learning (learning without traditional constraints) allows the continued education of large populations separated by vast geographical distances. In this paper the author provides a brief description of distance education and how it applies to medical education. The essential attributes of distance education include: quasi-permanent separation of teacher and learner, provision for two-way communication between student and teacher (tutor), use of technical media to unite teachers and learners and an absence of the learning group so that people are taught as individuals and not in groups. Distance education has adopted the established theories of teaching and learning including Skinner's behavior control model, Egan's structural communication model, Bruner's discovery learning model, Carl Roger's facilitation model and Holmberg's theory of didactic conversation. The authors go on to discuss both the process and potential of distance education concluding that continuing education of health professionals is a major area where DE can be applied cost-effectively.

Stephenson E. The distance learning course in occupational medicine. Journal of the Society of Occupational Medicine 1986; 36: 136-140.
Summary: In this paper, the author describes the development of the Distance Learning Course in Occupational Medicine from 1979 to 1985. The pilot project comprised four elements: written teaching manuals, seminars covering the teaching manual topics, tutorials and practicals. Based on questionnaires and interviews (results not provided in this paper) from the pilot test, the Medical Advisory Committee advised that the course be made available to a larger number of occupational physicians and a fee-paying course was developed. A postal survey was conducted to determine interest in the course and an acceptable fee for the program. A total of 273/655 returns showed interest in the course (2500 surveys were mailed initially). Over one-half (152) were prepared to pay their own fees provided they were not too high. An annual fee of £795 was decided upon and the first course was launched in October 1984. The program was designed for doctors in the UK but a

number of inquiries have come from oversees. The author concludes that the course seems to be living up to the needs of the occupational physicians and its initial demand has lived up to the expectations of the organizers.

Tann J, Hodges M, Stewart BJ. Evaluation of distance learning packages for residential homes and patient medication records. The Pharmaceutical Journal 1992; 248:
Summary: In this paper the authors discuss the implementation and evaluation of two distance learning packages for residential homes and patient medication records. The participants of the study were 650 pharmacists who completed the residential homes program and 650 pharmacists who completed the patient medical records program. The subjects received a questionnaire with their appropriate package which allowed comparison between those subjects who completed the distance learning package alone and those who completed the distance learning package and also participated in a workshop. Feedback on the course was generally positive and a majority of participants believed that the course objective had been met. Questions that involved professional judgement and some extra thought were answered the best. Hands-on experience in the workshops was also rated as desirable.

Thomson LAM. Meeting continuing professional education needs. British Journal of Nursing 1994; 3(14): 718-720.
Summary: Nursing and midwifery practitioners still face a limited choice in satisfying their learning needs. This article describes a collaborative venture to resolve this problem. A clinically oriented, flexible opportunity now provides study to an advanced level of practice through a distance-learning program. This student-centered, continuing professional education program is problem and practice oriented.

Treloar CJ. Evaluation of a national and international distance education programme in clinical epidemiology. Medical Education 1998; 32: 70-75.
Abstract: Distance education (DE) has been used as a teaching mode for over 100 years for a variety of academic, vocational and recreational courses. This paper describes a postgraduate clinical epidemiology course conducted by DE for Australian and international health professionals and compares the educational experiences of three groups of students (on-campus part-time, Australian DE and international DE). The groups were not expected to differ in academic achievement (marks) in eight subjects or in degree completion rates. The marks in each subject were not significantly different and typically were within five marks across all

student groups. Approximately 40-50% of Australian DE students completed the graduate diploma coursework requirements in the minimum 2 years study. The completion rate increases to 70-80% as the period of candidature increase. The completion rates of Australian DE students were not significantly different from those of on-campus part-time students. Evaluation of the course by degree completion rates, comparison of academic achievement between off-campus and on-campus students and qualitative feedback from students demonstrates that DE is as successful as on-campus teaching in providing training in clinical epidemiology at the postgraduate level. The flexibility of this mode of training as a means of providing public health training is discussed.

Whiteman J, Scott EM, McElnay JC. Analysis of pharmacists' attitudes toward a distance learning initiative on health screening. American Journal of Pharmaceutical Education 1994; 58: 300-306.
Abstract: A questionnaire was developed to investigate pharmacists' attitudes to distance learning (DL) as a vehicle for continuing education (CE). It was included in each of a two- part DL course on Health Screening. Part one was mailed to all community pharmacists in England (16,400) and returns were received from 1487. The questionnaire in part two was returned by 436 pharmacists. Attitude statements were scored using a five point Likert scale. The mean response to all attitude statements was positive. Participants were significantly more satisfied than non-participants with DL in general and the DL course studied ($p<0.05$). Over 80 percent of respondents completing the course found DL to be enjoyable and more suitable than other CE methods. More females and less males than expected (based on registration statistics) requested ($p\leq0.001$) and completed the course ($p\leq0.001$). Pharmacists of all ages participated, although those recently qualified showed greater interest.

Williams J. From face to face to distance: experiences of a midwife teacher. British Journal of Midwifery 1998; 6(4): 230-233.
Abstract: Distance learning has become an accepted and highly regarded mode of study. The role of supporting distance learning students, however, presents new challenges to the tutor and necessitates a change in role. This article describes the challenges the author has had to face as a result of working independently as a midwife teacher supporting midwives studying distance education courses abroad. The author offers an insight into the roles, responsibilities and skills required of a distance education tutor and how her role has changed as a result. The results of the author's survey that was sent to her students to gain insights into their reactions to the course and the demands it makes upon them are included. Their responses have been

helpful to the author in self-evaluating her own performance and how her current role will be helpful for any future education posts.

Wilson AL, Wellman LR, Fenton LJ, Witzke D. Development of a correspondence CME course for rural physicians. Journal of Medical Education 1982; 57: 635-637. *Abstract:* Providing continuing medical education (CME) for physicians who practice in rural areas presents unique challenges. Attendance at an educational meeting is difficult for these practitioners when patient coverage is limited. To address this issue, a correspondence course in postgraduate education was attempted in the sparsely populated state of South Dakota. Since community physicians in the state expressed a need for current information about the outcome of the pre-term newborn, this topic was chosen as the subject of the course. In this communication, the authors describe how the course was administered and evaluate its effectiveness.

Audio-Mediated Learning Technologies Abstracts and Study Summaries

Adams S. A Self Study Tool for Independent Learning in Nursing. The Journal of Continuing Education in Nursing 1971; 2(3): 27-31.
Summary: Nurses in rural areas encounter many challenges in pursuing their independent professional growth. They may be far removed from library resources, an educational telephone network (ETN), and/or educational television locations and may find access to current sources of nursing information difficult to obtain. The long distance to meetings of their professional association may also prohibit their attendance at such activities. In order to overcome these obstacles the Department of Nursing, Health Sciences Unit, University Extension, University of Wisconsin developed several independent study guides supplemented by a radio-telephone program over the Educational Telephone Network. This paper describes the project and its outcomes.

Anderson D, Harris M, McCosker H. Violence against women: An education program for rural community health workers. Australian Journal of Rural Health 1997; 5: 17-21.
Abstract: This study aimed to identify the educational needs of community-based rural health professionals regarding violence against women, and was funded under the Rural Health Support, Education and Training (RHSET) program. Focus groups and teleconferences were conducted with health workers, organizations and key individuals in the Wide Bay Region, Queensland, Australia. As a result, an education package has been designed that will provide specific training in violence against women for rural and remote health professionals working in the field. Rural health community workers identified the need to enhance their intervention skills and understanding on the issue of violence against women. A distance education framework based on adult and guided learning principles has been developed to meet this need. Six areas were identified as important learning needs and included: (i) Violence against women as a public health concern; (ii) The role of the community health worker; (iii) How the community health worker can empower women experiencing violence in their lives; (iv) Enhancing and developing supportive networks; (v) Building on community development action; and (vi) 'Where to next' for community health workers.

Arndt JR, Weinswig MH. Classroom Without Walls: Continuing Education Courses for Pharmacists via Cassette Tape Recordings. American Journal of Pharmaceutical Education 1973; 37(1): 61-64.
Summary: Continuing pharmaceutical education is the continuing of a pharmacist's formal preparation for practice through a series of educational experiences. Many factors can discourage pharmacists from participating in continuing education activities which take them from their home communities. Among these are the disruption of normal work schedules, as well as such economic factors as expenses for relief personnel and travel time. The authors describe a project developed by extension services in pharmacy at the University of Wisconsin-Madison which

involved the use of cassette tape courses for continuing pharmaceutical education. Cassettes are small plastic enclosed devices which house miniature reels containing magnetic tape 1/8 inch wide and varying in length. Cassettes are placed in standard cassette player-recorders and are activated simply by pushing a button. Each lecture was supplemented with a printed lecture guide and self-assessment test. The lecture guide contained a short lecture outline, visual materials, and a list of suggested readings. After the individual has studied the materials, he may request to take the final examination for continuing education credit which is sent by mail.

Blank JW, Kirk KW, Weinswig. Evaluation of an audio cassette tape lecture course. American Journal of Pharmaceutical Education 1975; 39(3): 275-78.
Summary: The introduction of audio magnetic tapes as an independent study technique has provided pharmacists with an opportunity to continue their education without travel, at the time, place, and pace they choose. Extension Services in Pharmacy at the University of Wisconsin has developed several audio cassette courses, each course consisting of seven or eight tapes of one hour. Accompanying each course is a notebook with lecture outlines, diagrams and case histories. Self-help check tests are also included and final examinations are available to participants who request certification. This paper describes the use of cassette tapes in continuing pharmacy education at a distance.

Boh LE, Pitterle ME, De Muth JE. Evaluation of an Integrated Audio Cassette and Computer Based Patient Simulation Learning Program. American Journal of Pharmaceutical Education 1990; 54: 15-22.
Abstract: To remain current with the rapidly expanding knowledge of pathophysiology and pharmacotherapy pharmacists have utilized the resources of traditional continuing education programs. Unfortunately, most of these programs are pedantic and offer little, if any, opportunity to apply this new information during the program. This report describes: (i) an innovative self-directed approach to CE which combines and integrates the technologies of audio-cassettes and microcomputer case simulations; and (ii) an evaluation of this approach in terms of participant attitude, knowledge gain and knowledge application. A total of 105 pharmacists who volunteered to participate, were randomly assigned to an experimental (EXP) group (received audio-cassette and microcomputer simulation) and control (CON) group (audio cassette only). Participants were evaluated with a pre- and post-examination and a telephone patient case simulation. Results of an attitude survey completed upon completion of the program, indicate equal satisfaction with the audio cassette portion of the course between the groups. The EXP group expressed a similar positive satisfaction with the computer simulation portion of the

course. Both groups demonstrated a significant increase in knowledge, with a mean increase of 16.10 percent (CON) and 28.38 percent (EXP). Meanwhile, the EXP group demonstrated a greater improvement in the direct application of the course information as measured by the telephone simulation. The positive experience and performance of the experimental group is supportive and encouraging for this innovative approach to providing CE which fosters the integration of knowledge and application.

Burton J, Morris J. Teleconferencing. CET information sheet 7. Council for Educational technology; London, England. 1986. ED 279 292.
Abstract: This information sheet defines teleconferencing as a meeting of three or more people at different locations by telephone or communicating via audio conferencing, audio plus graphics, slow scan television, or full motion video conferencing, and discusses some of the advantages and various applications of this technology. Three major projects that have been influential in the implementation and use of teleconferencing are described: the University of Wisconsin's Educational Telephone Network (ETN); the Learn Alaska Network in the United States; and the Open University in Great Britain. Current developments in teleconferencing in the UK are reported via a discussion of its use as an educational tool and brief descriptions of 13 projects, which range from tutoring groups of medical students dispersed in local hospitals and distance education programs in music and technology to continuing education for veterinarians and staff development. The work of PACNET (Plymouth Audio conferencing NETwork Project) is highlighted because of its significant contribution in exploring audio conferencing in education and training. Guidelines for getting started with audio conferencing include information on choosing telephone systems and equipment, companies that provide audio conferencing services, and devices that can be used on public networks. Also included are a glossary and a list of 22 selected readings.

Canavan C. Nurses' CE options expand with distance learning. American Journal of Nursing 1997; 97(10): 59-60.
Summary: In this paper, the author discusses the continuing education options available to nurses via the technologies of distance learning. The author describes how three of the more common distance learning technologies, audio-conferencing, video-conferencing and the Internet have become the more popular means for providing continuing nursing education. These technologies eliminate travel costs and lost work time, thereby providing a very cost-effective means of obtaining CE. The author provides a brief description of the program offered by the American Health Consultants focusing on the ease of using the program. The author also

mentions continuing education opportunities being made available by the American Nurses Association, including the Online Journal of Issues in Nursing and audio-based educational seminars. The audio-taped CE programs may also be used by the AMA as an independent self-study program for CE credit.

Connell CM, Smyer MA. Telephone Conference Networks for Training in Mental Health. The Gerontologist 1986; 26(4): 339-341.
Abstract: A Telephone Conference Network was chosen to deliver in-service training to 73 staff members at 14 acute and extended-care facilities in Pennsylvania. The vast majority of respondents reported high levels of overall satisfaction with the program format and an interest in participating in additional programs. Only half of the respondents, however, reported that they would be interested in teaching the skills they learned to their patients. Guidelines for both telephone conference subscribers and professionals offering Telephone Conference Network programs are discussed.

Continuing Education Through Telemedicine. Bibliotheca Medica Canadiana 1988; 9(4):196.
Summary: According to the authors, the delivery of continuing education is one of the primary applications of teleconferencing in the health care system. Teleconferencing can be defined as two-way communication among groups or individuals remote from each other using a telecommunication medium. Three general types of teleconferencing exist -- audio only, audiographic (which involves the use of devices such as freeze frame television), or video. Given Canada's geography, it is a natural territory for distance learning, the country is vast and sparsely populated and this situation creates a need to link people to ensure the effective transfer of knowledge and the exchange of information. Established in 1982 as a joint venture between the Royal College of Physicians and Surgeons of Canada and Toronto General Hospital, Telemedicine Canada was a national teleconferencing network which boasted more than 360 participating sites nationwide, producing 35 different series in three categories: physician, nursing, and allied health. Registered participants were able to simply dial a phone number that automatically linked them to a live program. The authors provide an overview of the history of the program and its successes.

Cowell JM, Kahn EH, Bahrawy AA. The School Nurse Development Program: An Experiment in Off-Site Delivery. The Journal of Continuing Education in Nursing 1992; 23(3): 127-133.

Abstract: The purpose of this study was to evaluate the effectiveness of a teleconference program by comparing the multiple program outcomes of learners enrolled at three off-campus sites to on-campus Chicago-based learners. An adaptation of the Stake (1967) countenance model guided the evaluation. The data analysis consisted of descriptive statistics, cross-tabulations, and content analyses of comments. The results indicated no statistical differences between groups in grade point average, satisfaction with the program generally or with the teleconferencing process, tenure in school nursing, job stability, adoption of management strategies, and school health programs directed to aggregates.

De Muth JE, Kirk KW, Weinswig MH. Continuing Education for Non-Practicing Professionals: A Case Study of a Program for Pharmacists. Adult Education 1976; 26(3): 157-166.
Abstract: This study deals with the development and evaluation of a continuing education course designed specifically for temporarily non-practicing pharmacists. The course consisted of a one-hour audio cassette tape and a printed supplement covering materials based on needs expressed by non-practicing pharmacists in a previous study. This study shows that non-practicing pharmacists tend to be isolated from their profession, fail to participate in formal and informal methods of continuing education, and are apparently unable to keep up with changes within pharmacy. However, when provided with continuing education materials designed to fulfill their particular needs, these non-practicing professionals can regain a level of knowledge comparable to their practicing colleagues. Although the study involves only pharmacists, the authors feel the results could be applicable to other professions as well.

DeMuuth JE. Evaluation of an In-Depth Pharmacy Home Study Program. The Journal of Continuing Education in the Health Professions 1996; 16: 42-29.
Abstract: During 1990, an audio cassette learning package was developed to provide pharmacists with a practical review of cell molecular biology, recombinant DNA technology, and products developed through pharmaceutical biotechnology. The original program was presented as three discrete units and an updated 1992 version combined all the units into one program with additional supplemental information. During 1993, a study was undertaken to assess practitioners' evaluations of both these programs. The response rate to the study questionnaire was 65.3%. Of the 145 total respondents: 93.1% considered the program to be a valuable learning experience; 85.7% considered the method to be a convenient and time saving means for professional continuing education; and 84.1% indicated that they would recommend the program to a colleague. Regarding the mechanics of the program,

pharmacists agreed: (1) that course materials were presented in sufficient detail (94.5%); (2) that the quality of the audio cassettes (95.8%), printed materials (95.8%), and review check tests (81.9%) were high; and (3) with reported access to an audio cassette tape recorder (95.9%). There were no significant differences in the evaluations based on which of the courses the respondents completed.

Dillon CL. Distance Education Research and Continuing Professional Education: Reframing Questions for the Emerging Information Infrastructure. The Journal of Continuing Education in the Health Professions 1996; 16: 5-13.
Abstract: This articles reviews the evolution of the theoretical influences upon the study of distance education and explores the influences of the emerging telecommunications technologies upon questions important to the continuing professional education of health professionals. The article offers multiple frameworks for posing research questions designed to help us understand professional learning in the new telecommunications environment.

DuGas BW, Casey AM. Teleconferencing. Canadian Nurse 1987 May; 83(5): 22-5.
Summary: Since 1982, the School of Nursing at the University of Ottawa has been delivering baccalaureate of science degree courses to nurses in 10 remote centres using a telephone conferencing network. The technology is viewed as a means to extend the on-campus classroom in that professors are able to teach simultaneously to a live classroom on campus and to students in various remote centres. The three critical resources in the success of the network have included a liaison (coordinator) person at the remote sites to recruit nurses, a technician to operate the teleconference bridge and monitor for technical problems, and the faculty who enhance their teleeducation lectures with slides, videotapes, and transparencies which are sent to the sites in advance. The coordinators at each site see that audiovisual aids are available for the learners. The equipment consists of a telephone, a convenor (which is really an amplified telephone device), and microphones connected to the convenor. Additions may include an electronic blackboard and a television monitor at the remote sites. The authors conclude that designing a course for teleconferencing takes more advance planning and preparation. However, the technology is relatively inexpensive and the greatest challenges are in creating a class bond when students are separated by distance and solely connected by telephone.

Dunn WR, Hamilton DD. Competence-based education and distance learning: A tandem for professional continuing education? Studies in Higher Education 1985; 10(3): 277-287.

Abstract: Competence-based education is seen as a valid methodology for determining the contents of a continuing education program for any profession. At present there seem to be five main ways of deciding the priorities in professional continuing education – the subject-centered approach, task analysis, the Delphi technique, the critical incident survey and the behavioral event interview. These five are all discussed and critically examined, the arguments for and against each methodology being considered. This discussion draws on our practical experience in implementing these techniques in competence-based studies which we have undertaken in certain branches of medicine and in pharmacy. However, having determined the competencies needed by the profession, one is still left with the problem of how a continuing education program based on these competencies can be organized and conducted. It is quite clear from the attendance figures at medical and pharmaceutical meetings that the present continuing education provision is attracting a very low percentage and the comments of those who do attend are often critical. Our evidence indicates that one way ahead for all for all the professions is to make greater use of distance learning facilities, particularly those adopting an initial problem-solving approach. But much of the distance learning material available at present in the profession fails to acknowledge this and is little more than re-typed lecture notes or re-written text books. In other words, it is frequently dull. Distance learning, if it is to work in the context of professional continuing education, must meet the criteria which have proved successful with the medical and pharmaceutical professions. It must be convenient for professionals to use in terms of time and place; it must be relevant and should be oriented in terms of problems that professionals encounter, perhaps not often, but at least every two years; it must be flexible enough to allow some adaptation to individual needs and interests; it should include an element of self-assessment which allows the individual to recognize what he doesn't know but needs to know and immediately points him in the direction of where that need can be met; it must not concentrate on mastery learning (the topics and skills which have to be mastered) at the expense of the areas of speculation, the so-called "grey-areas" of practice which call for professional value judgements and decision-making skills; and it must be systematic in its coverage for today's provision is haphazard and opportunistic. It is against these criteria and this checklist that the distance learning provision in any profession should be measured.

Ebbert A. Two-Way Radio in Medical Education. Journal of Medical Education 1963; 38:319-328.
Summary: Radio is thought of by many solely as an instrument of mass communication whereby a message can be carried to a limitless but passive audiences. However, radio can also provide two-way communication between widely separated groups and in the field of education teachers and students at a

distance can be brought together by two-way radio to participate in discussions as though they were seated in the same classroom. This paper describes the early beginnings of postgraduate medical education utilizing two-way radio which began at the Albany Medical College in 1955. Initially, one hour programs of fifteen or twenty minute lectures were broadcast to six hospitals within a 50 mile radius of Albany with the remainder of the hour used to answer questions received via radio from doctors who were listening. At each participating hospital, a member of the staff served as the local moderator. Slides and educational materials were used to supplement the radio broadcast. The main advantage of two-way radio is the ability to bring together the teachers and the learners without the inconvenience of extensive travel. The author discusses the experiences of Albany College in establishing this radio network and offers recommendations for effective continuing education using the technology.

Elsey B, McIntyre J. Assessing a support and learning network for palliative care workers in a country area of South Australia. Australian Journal of Rural Health 1996; 4: 159-64.
Abstract: Palliative care might be described as a movement within the healthcare systems of many countries which has a strong voluntary backing in the wider community. Much of the developments in Australia have taken place in the metropolitan areas with 'cinderella' services attempting to make provision in rural and remote parts of the country. This paper describes and reviews an action research project designed to provide a support and learning network for palliative care workers in a country area of South Australia, using the telephone and interactive video conference facilities for communication purposes. The lessons of the project have applicability for other healthcare providers in rural and remote parts of Australia.

Finlay IG, Stott NCH, Marsh HM. Distance learning in palliative medicine. European Journal of Cancer Care 1993; 2: 38-40.
Abstract: A 1-year distance learning course, divided into six modules, has been developed at the University of Wales College of Medicine. The course which leads to a Diploma in Palliative Medicine. Study is based in the participant's own clinical practice, with reading and audio-taped materials supplied weekly. Written work, which is returned to the University Department for marking and comment, is designed to enhance team building within the student's own clinical practice by addressing factual, attitudinal, protocol and administrative approaches to care. The whole course is based on the principles of problem-based learning and learner-centred teaching. Course work contributes to the final examination mark. In addition, the students maintain a personal learning portfolio during the course. The portfolio

must demonstrate the student's ability to incorporate the course work into clinical practice and an ability to appraise their own medical decision-making. This portfolio contributes to final examination marks. Each participant must undertake and write a report on an audit of palliative care in his or her own clinical practice, which is marked towards the final exam. There are two residential weekends during which communication skills are taught; and these are formally examined in the final examination. We describe the course design and report the results of the first year. Twenty-six course participants entered the 1990-91 course, of whom 24 obtained the Diploma in Palliative Medicine, one with distinction.

Fraser Hale J, Hollander RB. Spanning the distance and resource gaps in health promotion and health education programs. Health Values 1988; 12(2): 46- 52.
Abstract: Traditionally, health care/health promotion professionals have relied on the face-to-face format for their teaching and are now becoming increasingly involved with new and creative ways to use microcomputers in educational technology. These methodologies have their limitations. Each is limited by the number of participants who can be reached at a given time, the availability of local experts, the existence of the necessary hardware and software, and accessibility due to special characteristics of the audience. These limitations often dictate what presentations health professionals can offer, what media can be used, and which groups will attend. Health care/ health promotion professionals must not lose sight of readily available, nontraditional, cost-effective methods that serve to enhance high level wellness in a broad and diverse population. The alternative health promotion delivery systems of radio, audioconferencing, and teleconferencing, as discussed in this article, can be used in a variety of settings (school, university, community, and worksite), applied to all levels of health promotion and education (elementary through university education and community/worksite offerings), and can increase awareness of additional methods of communication of health-related information by health professionals.

Gellman EF, Franke TC. Experience with Four Years of CME Teleconferencing at St. Louis Children's Hospital, Washington University School of Medicine. The Journal of Continuing Education in the Health Professions 1996; 16: 250-253.
Abstract: Four years of experience at St. Louis Children's Hospital (SLCH) teleconferencing to five remote sites has reinforced this as an effective method of delivering continuing medical education (CME). The program Early Bird Rounds (EBR) for Practitioners is teleconferenced weekly. It focuses on primary care subjects that can be applied immediately to ambulatory care practice. Its agenda is set by the Medical Education and Activities Committee (MEAC) of SLCH, using needs assessments and speaker evaluations. Speakers follow a protocol for

preparation and meet with the program coordinator. Slides are computer generated. The programs are interactive, and attendees complete evaluations. Educationally influential physicians at all sites have been helpful in maintaining attendance and in stimulating participation. There appears to be a positive effect on referral patterns from teleconferencing areas. The development of additional site-specific programs is a priority.

Goldstein FJ. Continuing Education via Cassette Tape. American Journal of Pharmacy 1972; July-August 144: 105-109.
Summary: The authors describe a project at the Philadelphia College of Pharmacy and Science which involved the use of cassette tapes to provide continuing pharmaceutical education. The two main advantages of cassette tapes were that pharmacists anywhere could listen to lectures prepared and delivered by various staff members, and in comparison to other education technologies like televised lectures, tapes could be replayed at the discretion of the listener. Decisions concerning topics to be presented were based on meetings of a continuing education committee and a mail survey to alumni. The distance courses also included printed outlines so that listeners could follow each speaker and quizzes to assist the self-study process.

Griswold KS. 2-Way Radio Conferences are Catalysts to Continuing Education. Pharmacy Times 1972; 38(Jan): 52-55.
Summary: Two-way radio conferences for members of the health professions were initiated by the Albany Regional Medical Programs in 1968. Early in 1971, the Division of Extension Services at The Albany College of Pharmacy, in cooperation with the Albany Regional Medical Program arranged programs for pharmacists. Using a special telephone hook-up the presenter can hear all questions and provide live answers to participants. In order to link the radio conferences receiving and sending radio equipment was installed in 52 hospitals in 27 counties in the region. Assistance in arranging the programs was performed by a consulting faculty of pharmacists and average attendance for each of the programs was reported at 211. The author describes the technology and some of the challenges which were encountered in using radio to facilitate continuing education for health care professionals.

Halliwell J. Is Distance Education by Radio Outdated? A consideration of the outcome of an experiment in continuing medical education with rural health care workers in Jamaica. British Journal of Educational Technology 1987; 1(18): 5-15.

Summary: This article tries to assess the merits of radio as a means for distance education, and to this end examines the findings from a little-known educational research project with rural health workers in Jamaica. A general perspective is established at the outset, against which some of the findings from that research, concerned with feasibility, effectiveness and costs, are used to evaluate the potential future role of radio with vocational education in the rural parts of developing countries.

Hart G. Teleconferencing for Nurses: Questions and Answers. The Lamp 1989; April: 14-15.
Summary: During 1989 the New South Wales Department of Health funded an innovative project to trial teleconferencing as a support mechanism for new nurse graduates entering the workforce. This trail of the use of teleconferencing was later extended to more experienced nurses working in isolated areas. Using teleconferencing, nurse participants were able to extend their professional network and update knowledge in crucial nursing issues. The author describes the considerable planning and organization which was involved in establishing the professional development network and preparing for each conference. Overall, teleconferencing was viewed as an economical way of providing professional support and continuing education because it involved no travel expenses and only a limited time away from the workplace.

Hart G. Teleconferencing: peer support for new graduates and preceptors. The Australian Journal of Advanced Nursing 1989; 6(2): 8-12.
Abstract: Teleconferencing was trialed as a means of providing peer support to preceptors and graduates participating in a graduate transition program. The project involved 35 registered nurses from eight different hospitals within New South Wales and this report summarizes participant evaluation of the first seven teleconferences. Despite some problems making telephone contact with on-duty nurses, 96 percent of respondents agreed or strongly agreed that teleconferences provide the opportunity to contact other nurses and share experiences and 100 percent agreed or strongly agreed that they would like to be included in future teleconferences. While giving valuable support to preceptors and new graduates, teleconferencing may also be an effective means of offering peer support and/or continuing education opportunities to registered nurses working in isolated settings.

Henry PR. Distance Learning through Audioconferencing. Nurse Educator 1993; 18(2): 23-26.
Abstract: As more students living at a distance from campus seek nursing degrees, eliminating barriers to their access will require creative solutions. The author describes the advantages and disadvantages of audioconferencing to overcome barriers of distance and how to plan, implement, and evaluate such a course.

Herman CM, Buerki RA. Continuing Professional Education via Radio: A Review of the Literature 1977; American Journal of Pharmaceutical Education 1977; 41(May): 192-195
Summary: Health care professionals did not begin utilizing radio to augment their continuing education activities until 1955. The success of the Albany Medical College radio programs grew to the point in 1964 that the college conducted an invitational conference designed to make other medical schools aware of the effectiveness of educational radio. Since that time similar programs have been developed by the colleges of medicine at Ohio State, University of California, University of North Carolina, University of Utah University of Wisconsin, University of New South Wales. Although radio has been used as a vehicle for continuing professional education for over 20 years, it continues to suffer from a lack of the comfortable tradition associated with live-seminar programming and a lack of the contemporary glamour associated with computer-assisted instruction, closed-circuit television, audio and video cassettes. Moreover, the paucity of substantive research on radio as an acceptable and effective vehicle for continuing education of health professionals has slowed its growth. This paper discusses the use and implications of radio as a medium for delivering continuing professional education to health professionals.

Hibbard BM, Marshall RJ, Hayes TM. Postgraduate medical education by distance learning. The Journal of Audiovisual Media in Medicine 1986; 9(2): 70-73.
Abstract: In an attempt to solve some of the problems of providing continuing medical education for candidates preparing for postgraduates examinations in a geographically scattered region, a pilot study in distance learning was undertaken. The design of the postgraduate work was based on experience gained from a well established undergraduate distance learning programme using loudspeaking telephones over the public telephone exchange and lines. Six postgraduate centres participated in the programme. Emphasis was placed in tutorial teaching. Student reaction was evaluated from questionnaires and the interaction between the participants was measured. The teaching method proved to be popular with the teachers and students and a generally high level of interaction was achieved. The

system is relatively inexpensive and considerable financial savings to the Health Service could be achieved, whilst at the same time it provides opportunities for instruction by specialists whose teaching can be made widely available to numbers of postgraduate students that would otherwise find difficulty in attending, say, day release courses at the teaching centre.

Holt N, Crawford MA. Medical Information Service via Telephone: The Pioneer of Physician Consultation Services. Annals New York Academy of Sciences 1992 Dec 17; 670: 155-62.
Abstract: Alabama, progressive and modern in its five major metropolitan areas, is basically a state of rural communities. Although the definition of rural is highly debated, of Alabama's 67 counties, at least 45 (67%) would qualify in 1992 as rural, by any criteria. In times of crisis, health professionals over the state have always had a need for rapid communication with centre of medical knowledge. Today in Alabama, the talents and resources of the state's largest tertiary university medical centre are as close as the telephone for thousands of rural physicians and other health care processionals. Medical Information Service via Telephone (MIST) provides health processionals around-the-clock access to the Medical Centre of the University of Alabama at Birmingham (UAB). This telephone network provides toll-free links to the faculty and staff at the UAB Medical Centre 24 hours a day, seven days a week. MIST, the nation's first person-to-person physician communication network, was begun at UAB 23 years ago with a mission of education, research, and patient care. MIST has served as the model for dozens of similar programs being planned or implemented in other states and abroad. Programs patterned after MIST have been started in Michigan, Washington, Kentucky, Kansas, Arkansas, Texas, North Carolina, West Virginia, New Mexico, and Arizona - to name a few.

House AM, Roberts JM, Canning EM. Telemedicine provides new dimensions in CME in Newfoundland and Labrador. CMAJ 1981; 124: 801-802.
Summary: Physicians located in the more remote parts of Canada do not have convenient access to programs such as continuing medical education (CME). A teleconference system is a response to the challenges of rural physicians' access to CME. In Newfoundland and Labrador the CME department organizes weekly Wednesday at Noon, one-hour long teleconference sessions. The teleconference system operates like a modified party line with groups of physicians in different hospitals using microphone and speaker equipment instead of a telephone. In order to supplement the interactive audio system, copies of audiovisual or written supplementary materials are prepared in advance and circulated to all participants. Physicians who miss programs can listen to them later by requesting that the CME

office tape record and replay a session on the system. Technical equipment also allows ordinary dial telephone lines to be bridged into the dedicated system. This paper describes the teleconference system which is in place and offers several tips for the effective delivery of CME at a distance.

Jack BA. Open learning in nurse education. Nursing Standard 1993; 7(41): 30-31.
Summary: Much confusion surrounds the meanings of terms such as flexible learning, distance learning and open learning. In this article, the author highlights the difference between these types of learning and their advantages and disadvantages, and stresses the importance of all grades of nurses adopting the philosophy behind the initiative.

Jobe BD. 10 ways to participate in continuing education. Pharmacy Times 1971; 37: 38-43.
Abstract: Pharmacists are urged to realize the need for exposure to some types of continuing education in order to remain professionally competent. Various types of continuing education programs are discussed, with emphasis on ability of the pharmacist to attend without job conflicts. Possibilities for the practicing pharmacist include: (1) reading the literature, (2) local medical and pharmaceutical society meetings, (3) state and national meetings of professional organizations, (4) hospital-based continuing education programs, (5) regular interchange of information with colleagues, (6) special correspondence courses, (7) closed circuit TV programs, (8) refresher courses offered by pharmacy colleges or organizations, (9) participation in in-service training programs, and (10) contributing to a teaching or internship program of a pharmacy college.

Kasworm C, Hampton LA. Alexander Graham Bell in Professional Continuing Education. Adult Leadership 1976; 24(7): 242-3.
Summary: The University of Georgia Centre for Continuing Education and the School of Pharmacy developed a telelecture communication system that allowed for convenient, ready access by practitioners, at a minimal cost. Telelecture is a telephone communication system that permits the instantaneous transmission of a verbal presentation to widely dispersed geographic locations by utilizing an amplifier-speaker via a telephone network relay. Visual slide media can also be simultaneously shown to participants to clarify and reinforce the verbal presentation. The telelecture system has the potential for linking together pharmacy practitioners in their respective communities with authority resources originating from the University campus. Cluster groupings of practitioners in each selected community meet for the

purpose of attending the telelecture series and to offer an informal discussion group. At each site a local moderator is designated to assist with the telelecture presentation. The authors discuss the system and outline the reactions of participants to participation in continuing education at a distance.

Kuramoto AM, Dean JL. Audiographics Teleconferencing. Journal of Nursing Staff Development 1997; 13(1): 13-17.
Abstract: Teleconferencing is considered an alternative to traditional educational programming and can be accomplished through various methods. In this article, the authors explain audiographics, a form of teleconferencing that combines audio conferencing with a personal computer-based visual conferencing system. The authors discuss the system, the planning process, and the implementation and evaluation of audiographics during an 8-week continuing education course.

Kuramoto AM, Wyman JF. Design and implementation of effective delivery approaches for continuing nursing education. MOBIUS 1986; 6(1): 6-10.
Abstract: This paper describes the overall principles for designing continuing education courses for adult learners. A three year grant project enabled the University of Washington School of Nursing to design, implement and evaluate three delivery approaches for continuing nursing education in the state of Washington. These delivery approaches included: 1) a teacher "live" class; 2) a teleconference class; and 3) independent study packages for individuals or groups. The purpose of the project was to develop and compare the effectiveness of theses three delivery methods for delivering continuing nursing education. Variables examined included demographic data, attendance, attrition, cognitive achievement, attitudes toward the instructional delivery method and course content, and learner satisfaction.

Lewis JM, Farrell M. Distance education: A strategy for leadership development. Nursing and Healthcare: Perspectives on Community 1995; 16(4): 184-187.
Summary: In this article the author discusses distance education and how it applies to leadership development in nurses. It is believed that in the future, nurses will play a major role in the legislation, definition of standards and policy determination in health care. Thus, there is a necessity for nurses to obtain or update skills in leadership development. Time and money considerations have proven to be the largest obstacles in continuing education for nurses. Distance education offers a flexible, cost-efficient solution to this problem. The authors note that the focus of a distance education program is student learning rather than presentation of knowledge. Thus a quality DE program will have some means of determining prior knowledge and monitoring the learning process to ensure learning has occurred. The teacher

functions as a facilitator and collaborator in the distance learning process. Because the target audience in distance education programs is usually comprised of adults, there is good reason for the adaptation of adult learning theories. They promote active participation in the learning process and they are normally competency-based in which the learner faces only self-competition to pass the program. The authors go on to discuss several DL programs around the world that have enabled busy nurses to become more qualified leaders who are now prepared to address the societal concerns in health care. The authors also provide a list of actions that will help to maximize the potential of distance education for leadership development.

Lindsay EA, Davis DA, Fallis F, Willison DB, Biggar J. Continuing education through Telemedicine for Ontario. CMAJ 1987; 137: 503-506.
Abstract: Telemedicine for Ontario (TFO) is a continuing education program for health professionals. It is an interactive audio system, organized and operated by the five provincial medical schools, that is designed to offer otherwise unavailable educational programs to health processionals in northern or other isolated areas of Ontario. TFO has provided programs in three categories - medicine, nursing and allied health - and has covered a wide range of topics; the programs have been tailored to the stated needs and interests of the participants. By 1986 there were 189 sites throughout Ontario that participated regularly, and there were approximately 25,000 individual registrations in the 1985-86 seasons. Our results from this 3-year pilot study have indicated the feasibility of the medium and its acceptance by health professionals. The next stage of the program's evaluation will include analyses of its impact on clinical; practice and on the health status of patients.

Lockyer JM, Parboosingh IJ, McDowell AC. Teleconferencing and the Continuing Education Preferences of Physicians and Nurses in Rural Areas. MOBIUS 1987; 7(3): 53-58.
Summary: The use of audio teleconferencing for continuing education was pioneered in Wisconsin in the late 1960s and in Newfoundland Canada in the early 1970s. The medium has been found to be as effective as classroom teaching for transmitting cognitive information and is particularly useful for reaching professionals in remote locations. The authors describe and discuss the use of audio teleconferencing in Southern Alberta by the Faculty of Medicine at the University of Calgary and the Southern Alberta Perinatal Education Program at the Foothills Hospital in Calgary. The Alberta Hospital Association began offering programs to nurses and other health professionals and by 1985 continuing medical education sessions were being offered on a weekly basis. This article summarizes user perceptions of teleconferencing as a method of continuing education relative to other options available to them and

whether the perceptions that learners had about teleconferencing differed by their attendance at the sessions or by the number of years that their community had participated in programming.

McDowell CA, Challis EB, Lockyer JM, White L, Adams K, Parboosingh IJ. Teleconferencing CME Programs to Rural Physicians: The University of Calgary Teleconference Program. Can Fam Physician 1987; 33: 1705-1708.
Summary: Continuing medical education (CME) provides practising family physicians with the cornerstone of maintenance and improvement of skills. In rural areas the problems of isolation and distance are a barrier to continuing medical education. Provision of CME by audio-teleconferencing is an attempt to overcome these problems. This article describes the teleconference program of The University of Calgary, how it has developed over the five years of its existence, and its impact on rural physicians.

Meyer TC. Communications in postgraduate medical education. The Alabama Journal of Medical Science 1970 Apr; 7(2): 212-16.
Summary: The author discusses the use of several communications technologies in providing information and continuing education to physicians in Alabama. A dial-access library was established in an effort to provide physicians with immediate access to current, pertinent and authoritative information. In 1966, a library of 88 self-rewinding cartridge tapes, each of approximately 5 minutes were available to physicians 24 hours a day and could be obtained merely by making a telephone call and requesting the tape. In 1965 telephone/radio conferences were started with 18 hospital stations linked to the University by telephone. Each site had a loudspeaker, a telephone handset to communicate over the circuit, a carousel slide projector and screen. The format involved a 30-minute lecture followed by 30 minutes of questions and discussion.

Meyer TC. Teleconferencing as a medium for continuing education of health professionals: A fifteen year perspective. MOBIUS 1983; 3(2): 73-79.
Abstract: This paper describes 15 years' experience with narrow band telephony applied to continuing education of physicians and nursing staff in the state of Wisconsin. The telephonic approach is shown to be viable, effective and economical; especially so when compared to wideband video alternatives or peripatetic teachers. The department of Continuing Medical Education, University of Wisconsin-Madison, initiated the use of telephony for instructional purpose in non-credit continuing education in November, 1965. Facilities were installed for 18 hospitals, up to 350

miles from Madison, for use by 286 physician's two hours weekly. The program included lecture outlines, visuals and a full array of telephone equipment with lectures strictly timed yet allowing for questions and answers. The technical system was validated by a series of pretests and immediate and late- posttests of 52 physicians taking a telephone course. Technology was found not to interfere with the education process. The university has since enlarged the network by more than a factor of 10. By 1979-80 there were 1320 program sessions with participation exceeding 34,000 or 270,596 student contact hours, at approximately 45.33 per student contact hour. Drawbacks include lack of eye contact, difficulty in understanding foreign accents and necessity for videocassettes when demonstrations require movement. Strong points of telephony include its flexibility; variation in numbers attending and in visual aids; location of instructors and use in single subject/single day teaching. Telephony was found to be a uniquely useful means of providing continuing education to hospital and medical staffs.

Nath CJ, Thomasson CL, Iverson MJ, Davis P. The Effectiveness of Rate-Accelerated Speech in an Audio-Taped Continuing Education Program for Pharmacists. American Journal of Pharmaceutical Education 1981; 24: 155-160.
Abstract: This article reports the results of a study to determine the potential of using rate-accelerated (compressed) speech audio tapes as an alternative method of instruction in a continuing education program for pharmacists at Auburn University on Alabama. Comprehension, at up to 75 percent compression rates, and acceptance of the compressed tapes for continuing education were studied. A four group, pre-post-test experimental design was used with seventy-three pharmacists participating in the study. There were no significant differences among the mean scores of the four groups on the post-test. Thus, audio tapes presenting medical content of varying complexity can be accelerated to rates of 75 percent without having a significant effect on pharmacists' ability to comprehend; however, 40 percent compression was found to be the point of average comprehension. In addition, pharmacists were willing to accept the technique of rate-accelerated speech up to approximately a 50 percent compression rate, but beyond 50 percent, the pharmacists downgraded the value and use of audio tapes in future continuing education programs.

Oakley CL. Audiotapes in continuing medical education. MOBIUS 1983; 3(2): 80-85.
Summary: The "ideal" tool for the physician, especially the one practicing in a rural area far removed from medical teaching centers, would be a learning instrument he or she could utilize anywhere, anytime. This paper traces the genesis and growth of a teaching tool that is now utilized worldwide because it comes close to that ideal of

being useful in multitudinous locations where time is otherwise wasted, principally during automobile commuting.

Orgren, RA. Preventive Health care for the Aging Grand Rounds: A Statewide Interactive Telephone Conference Network. AJPH 1990; 80(7): 878-879.
Summary: This paper describes a distance learning project which involved the delivery of grand rounds on preventive health care for the aging and organized for public health nurses in the state of California. The technology which used was the interactive telephone conference. 47 telephone connections at a time were connected and typically small groups were assembled around the state where speaker phones were available. The rounds drew from 40 - 100 people per session and the agenda included a formal presentation, a question and answer period, and a presentation and discussion of related case studies. The sessions were scheduled to last one hour and materials are forwarded to participants in advance. The author noted that the use of case studies from the field as a teaching device proved to be very successful in making the conferences both practical and relevant, and also in generating greater participation in the discussions.

Parker LA, Baird MA. Continuing Education by Telephone: A Party Line for Professionals. JAHA 1977; 51: 105-112.
Summary: This paper outlines the development of an interactive telephone network which was developed in Wisconsin in 1965 to provide high-quality, low-cost continuing education to rural health care providers in their home communities. The Educational Telephone Network (ETN) is a closed-access telephone network which links university health science resources in Madison and national guest speakers with learners around the state. About 60 of Wisconsin's 140 general hospitals enroll annually in the telephone conference network. The University of Wisconsin-Extension Departments of Continuing Medical Education, Nursing, and Pharmacy joined together to offer more than 300 hours of educational programs to the state's hospitals. ETN classrooms have a suitcase-size speaker that plugs into a standard telephone jack and AC power outlet, and four microphones. Local program coordinators are appointed to coordinate, promote, administer and serve as local contacts for all programs at their designated sites. Fees for participating in the network are prorated according to the number of hospital beds. In addition to the programs, enrolled hospitals also receive ETN equipment, and installation of five jacks in the building.

Picot J. Teleconferencing: a new era in health care. Dimensions 1984; 61(3):35-7.
Summary: In this article the author discusses the various applications of teleconferencing technology in the health care field. This discussion includes a definition of what teleconferencing entails and a thorough description of the hardware and technical components which are required to use teleconferencing. Several examples of how teleconferencing can be used to transmit medical information and conduct educational activities and administrative meetings are presented.

Roeder SD. Evaluation of Teleconferencing for Continuing Pharmacy Education. American Journal of Pharmaceutical Education 1983; 47: 116-119.
Abstract: This study was developed to evaluate the response of practicing pharmacists to teleconferencing as an alternative educational method. Three programs of varying content and format were analysed on the basis of participant evaluations: two programs were evaluated following their initial presentation; one program was analysed following two years of serial programming. Programs were evaluated for relevance to professional practice, content and presentation. Results showed that pharmacists found teleconferences to be a convenient and effective method of continuing education and that the interactive aspect was of practical benefit and value. The instructional design techniques employed and educational packages presented were considered to be effective and helpful. Results were consistent over time and the medium provided to be cost efficient when compared to other instructional formats.

Rosner F, Gandhi MR, Lanzkowsky P. Teleconferencing for Graduate and Continuing Medical Education. Academic Medicine 1992 Jun; 67(6): 384.
Summary: The Long Island Jewish Medical Centre holds pediatric grand rounds via teleconference to five other hospitals. On a weekly basis three or four instructive cases are presented in one hour sessions. A software program also allows a personal computer to be used as an audiographic workstation to create, transmit, and receive graphic and video images between the various hospitals. These telewriter images are sent over standard telephone lines and the system allows the creation of color graphics from any video capture source (such as a video camera, videocassette recorder) or other software packages. The electronic tablet can also be used for interactive electronic black boarding, to exchange ideas and information. This paper provides an overview of audiographic teleconferencing technology and its use in delivering medical education programs to distant hospital sites. The authors describe the process which is involved in organizing medical education sessions at a distance using teleconferencing and the tasks required for preparing materials for audiographic teleconferencing. Case histories, physical examinations, lab data, and appropriate

pathology slides must be prepared and stored for transmission in advance. The day before the conference, all hospitals are called, workstations are connected through the telephone and the data pages are downloaded. On the conference day, two separate lines are used, one for voice and one for the computers

Savela EM, Enlund HK. Public Radio as a Means of Continuing Education in Pharmacy. American Journal of Pharmaceutical Education 1996; 60: 374-377.
Abstract: Public radio has been used as an educational medium in Finland for over 50 years, but not within pharmacy until 1990, when a radio series called "Safe Use of Medicines" was arranged. In the first part of the study we evaluated the listener response and listener activity by sending two questionnaires to a random sample of 22 pharmacies in Eastern Finland. In the second part of our study we measured the cognitive changes associated with three of the six programs that were recorded on audio cassettes and given as in-house training material to four large pharmacies with 64 participating assistant pharmacists. Despite positive attitudes towards continuing education via radio the readiness to participate was modest among pharmacy personnel in Finland. However, radio programs in the form of audio cassettes significantly enhanced the levels of participants' cognitive knowledge. According to the opinions of the participants, both radio programs and audio cassettes are suitable means of continuing education for keeping up pharmacists' professional skills. The participants found it desirable to arrange this kind of education in the future as well.

Screnci D, Hirsch E, Levy K, Skawinski E, DerBoghosian M. Medical Outreach to Armenia by Telemedicine Linkage. Journal of Medical Systems 1996; 20(2): 67-76.
Abstract: Telemedicine, an electronic mode of transmitting medical information interactively between remote sites, was launched as an educational support for a 3-year-old medical partnership between Boston university School of Medicine and Emergency Hospital, of Yerevan, Armenia. Emergency Hospital is the first site in Armenia to have an audiographic teleconference capability linking it to a major medical centre. Emergency Hospital and Boston University School of Medicine share the remote connection in order to allow educational conferences, peer consultations, and distance learning to take place, thus enhancing the partnership's aims to improve the emergency and trauma care system of Yerevan. To date, eight teleconferences have been transmitted linking 100 physicians, nurses and hospital administrators. The teleconference program provides, in effect, a formal continuing medical education program for Emergency Hospital. It is a key tool of low-cost technology transfer with the potential of broadening resources over the wide territory of the 15 republics of the former Soviet Union. The Telemedicine system is

comprised of Optel Communications' Remote Viewing System computer hardware and software plus tow dedicated AT&T telephone lines. The system has been in use at Boston University School of Medicine for live voice and still image transmission between international sites since 1987. This level of technology suited environmental conditions in Armenia, marked by frequent power outages and unreliability of local telephone connections. A protocol for presentations was established governing length of time, number of visuals per session, visual format, compatibility with interpretive services, congruence with project mission, and adaptability to local conditions that was shown to provide clear and concise delivery of the information necessary. This paper reports the process of development, installation, and initial use of the technology in one nation of the post-Soviet world.

Shomaker D. WSRN state of the science papers. Research in nursing distance education: defining the elephant. Communicating Nursing Research 1995 Spring; 28: 133-45.
Summary: Technology is improving, information is expanding, the two are converging, and all the while the cost for delivering distance learning is decreasing. The question now is not what technology to use, but how best to use it. Most faculty still need more preparation in mastering a bank of skills for teaching at a distance. According to the authors both present faculty and new faculty should be taught the technology and skills for its effective use, and be given substantial professional assistance in the design, production and evaluation of distance learning programs. Those faculty who are negative about distance education have concerns about the absence of face-to-face contact, calculation of work loads, financial rewards, and research and publication. This article discusses some of the implications of teaching at a distance for faculty and educational institutions.

Sloane D. Teleconferencing: innovations promise bright future. CMAJ 1984; 130: 476-478.
Summary: The author describes the hardware components which are required for the effective operation of a variety of teleconferencing services over narrowband telecommunication systems. Teleconferencing is a useful tool which can enhance productivity and reduce operating expenses and human communication skills are critical to its success. A teleconferencing system is really made up of four major components - terminals, transmission equipment, bridging apparatus, and users. Narrowband teleconferencing services provided over the public telephone network represent the main form of teleconferencing. These services include audio plus teleconferencing, freeze-frame TV, electronic blackboards, and graphic tables. The author concludes that improving the capabilities of narrowband facilities will require

a combination of new terminals, improved and augmented transmission systems, suitable bridging equipment and a signalling scheme to permit their use. Ultimately the problem is likely to be solved by improvements in digital technology.

Sternberg RJ. Electronic Conferencing for Continuing Medical Education: A Resource Survey. MOBIUS 1986; 4: 39-48.
Abstract: The use of electronic technologies to link participants for educational conferences is an option for providers of Continuing Medical Education. In order to profile the kinds of electronic networks currently offering audio- or video teleconferences for physician audiences, a survey was done during late 1985. The information collected included range of services, fees, and geographic areas served. The results show a broad diversity of providers providing both interactive and didactic programming to both physicians and other health care professionals.

Synder JR, Thompson RP, Luebbert PP. Continuing Education for Medical Laboratory Personnel: The Telephone Conference Approach. American Journal of Medical Technology 1982; 48(8): 691-696.
Abstract: In the wake of a health care knowledge explosion, maintaining practitioner competency is an important concern of both practising health care professionals and the many certifying and licensing bodies. One approach to this issue, particularly for professionals in rural areas, is the use of telephone conferencing. With this approach, the practitioner is able to participate in continuing education by listening to a lecture broadcast over conventional long-distance telephone lines. In advance of each program, printed and visual materials are forwarded to the respective conference sites. At the end of the lecture, each participant is given the opportunity to engage the speaker in a question and answer session. This paper describes the programmatic activities related to developing, implementing, and evaluating the telephone conference approach. This approach, with respect to the continuing education of medical laboratory personnel, has been operating at the University of Nebraska Medical Centre for the past seven years.

Takacs ED. Teleconferencing links 10 sites in New Brunswick. Dimensions in Health Services 1984; 61(7): 19.
Summary: Teleconferencing was introduced as a pilot project at the Dr. Everett Chalmers Hospital and the rural catchment area surrounding Fredericton, New Brunswick in 1982 and 10 sites participated in continuing education programming using audio teleconferencing and video transmission (slow scan freeze frame) technologies. Teleconferencing equipment included a Darome convenor (amplifier)

and several microphones which were located at each site. Each participating facility called into a bridge located in Fredericton which permitted two-way telephone conversation to be simultaneously heard by any other number of participants who had also dialled into the bridge through a port. Coordinators in each facility assisted with program scheduling, setting up the equipment and equipment training. Weekly grand rounds were broadcast and chaired by the chief of staff and formats included seminars, case presentations, and clinical pathological conferences.

Thornton RN. Nursing School of the Air. The Australian Nurses Journal 1986; 16(1): 50.
Summary: The authors describe and discuss the origins and development of a two-way radio communication network in Australia which is used for the continuing education of health care professionals in rural and remote areas of the country. The aim of the network was to provide in service education at a distance and was conceived to offset the remote and country nursing processional isolation, and to assist those who experienced difficulty in obtaining traditional in service education other than by travelling into regional centres.

Togno JM, Lundin R, Buckley P, Hovel J. Rural health and IT&T in Australia - the results of qualitative and quantitative surveys of the needs, perceptions and expectations of rural and remote health professionals. Journal of Telemedicine and Telecare 1996; 2 Supp. 1: 104-105.
Abstract: This paper reports an initial overview of the findings of qualitative and quantitative surveys of rural and remote health professionals in Australia to determine their present use of information technology and telecommunications (IT&T), barriers to the use of IT&T, and expected future uses. The survey research commissioned for this project supports the degree of importance rural and remote health professionals attach to the introduction and use of IT&T to reduce their sense of professional isolation and to support their service provision.

Treloar LL. Facts About Teleconferencing for Staff Development Administrators. The Journal of Continuing Education in Nursing 1985; 16(2): 47-52.
Summary: This article provides an overview of telephone-based instruction as a communications medium for providing continuing education programs for nurses. It describes factors that the administrator of a hospital-based staff development department will want to consider in implementing and utilizing teleconferencing for continuing nursing education activities. In addition, it discusses some of the

implications that the implementation of a teleconferencing system at St. Francis Hospital has had for members of the staff development department.

Wood JB, Teitelman JL, Parham IA, Saidman MK. A model for teleconferencing in geriatric education. Gerontology and Geriatrics Education 1988; 8(3/4): 81-93.
Abstract: In this article, a successful model for implementing educational teleconferencing based on the experiences of the Geriatric Education Center at Virginia Commonwealth University is described. Components include the technical and human resources needed, processes involved, and key areas of responsibility. Teleconferencing offers many benefits as a medium in geriatric education. As a vehicle for continuing professional education, teleconferencing is a cost-effective means of transmitting "state of the art" information to large numbers of health professionals in a variety of settings. Participants at receive sites across the nation are able to engage in interactive dialogue with faculty with national reputations in their given areas of expertise via live video broadcast and audio hookups. The potential advantages of the teleconference medium to both program sponsors and participants are described in detail, and specific implications for geriatric training are discussed.

Wuest J. Learning contracts: a vehicle for increased student involvement in audio teleconferencing. Nurse Education Today 1991; 11: 185-190.
Abstract: Increasing demand for baccalaureate nursing education for registered nurses delivered by audio teleconferencing creates many challenges in course design and delivery for nurse educators. In this paper, the strengths and limitations of contract learning as a means of increasing student involvement are discussed from the perspectives of both student and teacher, in light of both adult learning theory and the unique demands of distance education.

Video-Mediated Learning Technologies Abstracts and Study Summaries

Alderman C. Learning on the airwaves. Nursing Standard 1991; 5(35): 20-22.
Summary: This article provides an overview of a continuing education television broadcast project which involved a collaboration between the RCN, Nursing Standards and the BBC. The program was produced to use not only television, but also the written word. The broadcasts were supplemented by material printed in Nursing Standard. Subjects included asthma and standards of care, pain management and accountability and were presented in one hour segments.

Allan DME. The Rationale for the Interactive Videodisc in Continuing Education. MOBIUS 1986; 6(3): 37-42.
Summary: Some of the key characteristics between health professionals and their learning are that professionals should control the content, method and speed of their own learning, that learning should be based on real problems in real work situations, that learning should have immediate application and should encourage consistent and efficient patient management behaviours. Computer-based instruction programs are an example of new technologies which allow the learner to control his or her learning. Optical-disc technologies add the visual images lacking in computer-based instruction by storing images from film, videotape, slides, photographs, data screens, computer graphics and animation with a very high quality of reproduction. Each side of 12-inch laser videodisc can hold 54,000 frames and the laser beam that reads these frames and translates them into visual images can rapidly access any individual frame. This article provides an overview of the interactive videodisc, its use for continuing education of health professionals, and identifies several instructional design strategies for utilizing these technologies.

Altrudi R, Eurnekian A, Gandsas A, Silva Y, Silvestri V. Videoconferencing as a Medical Educational Tool: First Experience in Argentinean Public Hospital. Studies in Health & Informatics 1998; 50: 364-365.
Abstract: The authors present their experiences with a medical videoconferencing program developed in a public Argentinean hospital. Both modalities - room and desktop videoconferencing - were used. The program was exclusively used for educational purposes. A total of twelve videoconferencing sessions were successfully made. They included surgical procedures, magisterial lessons, grand rounds, etc. The project proved the videoconferencing is a cost-effective medical education tool, even in developing countries.

Arnold MS. Distance learning for occupational health nurses in Ontario... Part 1. Registered Nurse 1994; 6(4): 37-40.
Summary: This paper argues that there is a need for educational institutions to re-examine existing programs and to work toward the design of more efficient and effective programs that will be accessible to all qualified nurses, regardless of where

they live and work. The occupational health nurse in today's health care system must have, in addition to training and qualifications as a nurse, sufficient knowledge in environmental and occupational health assessment, rehabilitation and disability management, health education and promotion, and legislation of the workplace. Thus, for most, continuing education is necessary. Traditional approaches to continuing education are no longer acceptable for most nurses. They are expensive, inconvenient, rigid and often irrelevant. The concept of open learning is beginning to emerge as a viable option to this dilemma. In open learning, many barriers (timing, location and pace) are removed and the responsibility of learning is placed on the learner. A quality DL program should address the student's objectives and provide a clear statement of purpose. Well-defined objectives should also be included along with a student support system and an efficient student and course evaluation system. The author concludes by saying that distance learning programs must allow the learner to learn independently between the occasional periods of interaction with tutors and other students.

Ball K, Perez J, Facoog DO, Theslof G. Video Conferencing in Surgery: An Evolving Tool for Education and Preceptorships. Telemedicine Journal 1995; 1(4): 297-301.
Abstract: The advent of advanced laparoscopic procedures has provided unquestioned patient benefits but has also engendered significant concerns about whether surgical team members are able to stay current in this ever changing arena. The interactive videoconferencing program at Doctors Hospital in Columbus, Ohio, was developed to improve the education and preceptoring of surgical teams. This article describes the evolution of the program and its basic technology and connectivity. Physicians and other health care professionals began to accept this teaching alternative as usage increased. Based on this initial experience, video conferencing in surgery appears to be a valuable and exciting method of enhancing the educational process and augmenting the preceptorship experience. Further studies need to be conducted to determine the actual cost-effectiveness of this teaching method.

Ball, K. Riding the Superhighway of Education with Video Teleconferencing. Minimally Invasive Surgical Nursing; 8(3): 114-115.
Summary: A new alternative to enhance the delivery of continuing education is now rapidly evolving in the health care arena: video teleconferencing or video conferencing. This communications system of audio and visual images can use satellite or telephone lines for transmission. Video conferencing is used to share information between groups of practitioners at different hospitals so they can communicate quickly and efficiently. This enhanced learning environment eliminates travel time, decreases expenses, and minimizes time away from the

practice setting. The author describes the technical requirements for organizing and implementing a videoconference and discusses the advantages and disadvantages of the technology.

Benschoter RA, Benson SJ. Satellite System Addresses Rural Health Problems. JBC 1992; 19(4): 26-30.
Summary: The University of Nebraska Medical Centre uses the recently established NEBSAT state-owned satellite television system to transmit several types of educational presentations to rural Nebraska. The system represents the latest in a series of pioneering two-way television activities which have opened educational opportunities to students and professionals off-campus. Compressed video, transmitted via the NEBSAT system, allows us to share credit courses in nursing and medical technology, administrative meetings, case conferences, and continuing education programs.

Bergvik S, Gammon D. Video Conferencing in Group Training of Psychiatric Nurses. Studies in Health Technology and Informatics 1997; 46: 481-486.
Abstract: Video conferencing (VC) technology transfers synchronous audio and video signals via standard telecommunication lines. VC has become a useful communication device in the mental health care sector in Norway, particularly in the northern counties. Training and supervision is considered one of the areas where VC has great potential. This study followed a group if nurses who used VC in a training program every other week over a period of six months. The group consisted of seven nurses (two supervisors and five supervises). Data was collected from four of the VC sessions. User satisfaction and judgements on the effect of VC on critical aspects of the supervision were evaluated through questionnaires. In addition, a closing group interview was held to sum up qualitative experiences and attitudes. Results indicate that VC may indeed be an acceptable tool in group supervision. Participants reported that they were able to establish a climate for communicating on an emotional and personal level, as well as provide the necessary feedback and psychological support.

BeSaw L. KCME-TV: Health channel brings home better continuing medical education. Texas Medicine 1997; 93(11): 50-52.
Summary: The author describes a project involving Baylor College of Medicine and the Williams Learning Network joining forces to launch the Health Channel which delivers original continuing medical education (CME) programming direct to physicians' offices or homes by satellite. Daily broadcasts provide accredited CME courses, as well as professional development and health care education programming for physicians and their staff. Programs cover such topics as stress testing, diagnosing depression, screening for alcohol abuse, new developments in the

management of atrial arrhythmia, lipid disorders, pulmonary function testing and arterial blood gases, and eating disorders in adolescents.

Billings D, Durham JD, Finke L, Boland D, Manz B, Smith S. Collaboration in distance education between nursing schools and hospitals. Holistic Nursing Practice 1994; 8(3): 64-70.
Abstract: Interactive television (ITV) is being used by increasing numbers of nursing schools and hospitals to provide educational access to geographically diverse learners and nurse employees. ITV-related research suggests that learner outcomes and satisfaction with such distance education courses are similar to those associated with the traditional classroom. The authors conducted an evaluation of a major nursing school's nursing telecourse program (NTP) to assess collaborative efforts with hospitals and regional campuses. The respondents, 15 site coordinators, were generally satisfied with the operational aspects of the NTP. Concerns raised by respondents included classroom space availability, operational costs, library resources, and communication equipment and processes. These stakeholders' perspectives were viewed as valuable in identifying problems and making improvements in the school's NTP.

Billings D, Frazier H, Lausch J, McCarthy J. Video conferencing: Solving Mobility and Recruitment Problems. Nurse Educator 1989; 14(2): 12-16.
Abstract: Many nurses and nursing students live far from the closest campus or health care agency that can provide basic or continuing education. Video teleconferencing is one way to bridge this distance. As video teleconferencing technologies become available and cost effective, nurse educators must be knowledgeable about their use. The authors explain the telecommunications technologies of video teleconferencing, identify advantages and disadvantages, and discuss planning, implementation, and evaluation strategies for offering a program by videoteleconference.

Bolte IM, Fleming JW. A Study of registered nurses who viewed the PANMED television program series in nursing. The Journal of Continuing Education in Nursing 1971; 2(5): 13-20.
Summary: This paper describes how PANMED (Pharmacy, Allied Health, Nursing, Medicine, Dentistry) used the Kentucky Statewide Education Television Network to deliver CE programs which were produced and broadcasted between 10:30 and 11:00 pm weekly with the five colleges rotating responsibility for presenting programs. These television programs were broadcasted over a network of 13 educational television channels located throughout the state. Some of the programs presented by Nursing included clinical practice, health problems, professional issues and management for nursing care. The authors also describe some of the characteristics

of the registered nurses in Kentucy who viewed or had heard of the PANMED program television series in nursing and their perceptions of the series.

Brick JE, Schreiber D. West Virginia's Mountaineer Doctor Television. Journal of Medical Systems 1993; 17(6): 371-376.
Summary: Because of its terrain and distance to urban areas it is difficult to recruit primary care physicians to rural West Virginia. In order to reduce feelings of isolation and to increase retention of providers in rural areas, the Health Sciences Center of West Virginia University established in 1990 the Mountaineer Doctor Television (MDTV) as a pilot project. The MDTV network uses a hub and spoke concept for multipoint communication between all of the sites. The technology utilizes compressed video, fully dedicated T1 lines for 24-hours a day online access and a network which is secure and confidential. This paper describes how the network is used for providing continuing education to rural physicians as well as a variety of other telemedicine consultations. Scheduled CME lectures are provided a minimum of three times per week and the topics are chosen via input from both the MDTV User's Committee and the entire medical staff of the spoke sites. In addition, the spoke site's physicians have opportunities to participate on a real time interactive basis in such regularly scheduled conferences as Family Medicine Grand Rounds.

Brown JP. Videoconferencing in Patient Care Delivery and Medical Training. The Journal of the Healthcare Information & Management Systems Society 1994; 8(3): 15-20.
Abstract: Videoconferencing technology is rapidly emerging as an increasingly useful tool in improving patient care delivery and expanding access to required medical training. As pressures mount to reduce health care delivery costs and increase access to quality medical care, the efforts of individual hospitals, regional health care systems, and state governments to install interactive videoconferencing systems will quicken and intensify.

Burleson S, Sugimoto T. Cancer Education via Video-Teleconferencing: An Assessment of Participant Responses. JBC 1984; August: 5-9.
Abstract: Two one-hour video-teleconferences on paediatric oncology were presented to a targeted statewide audience of cancer care providers and other professionals who work with pediatric cancer patients in the hospital, community, and home. Participant responses to a post-broadcast questionnaire addressing program content process, and units were then assessed. Of the 203 participants, 87.8% agreed that the program content would be useful to their practice, and 94.3% agreed they would recommend video-teleconferencing as an effective method for continuing cancer education.

Butler PM. Using ATS-6 for continuing medical education and health care in Appalachia. Applied Communication Research, Stanford, California. 1975. ED 115 251.
Abstract: Ten Veterans Administration hospitals in Appalachia participated in five biomedical communication experiments using the Advanced Technology Satellite (ATS-6). Material was collected and evaluated by both questionnaires and interviews with the medical staff of the 10 hospitals. The five experiments were conducted in the areas of: (1) video seminars, (2) grand rounds, (3) teleconsultation, (4) out-patient clinics, (5) computer-assisted instruction.

Byrne RB. Toward the year 2000: An overview of probable communication futures. MOBIUS 1982; 2(2):15-23.
Abstract: New communication technologies are transforming and dramatically increasing our ability to create, store, retrieve, manipulate, transmit, and receive information. This paper provides an overview of the possible impacts of emerging communication technologies upon continuing medical education. Discusses the use of linking (networks for communication, linking together users and user groups at specific remote locations at prescribed times) and self-contained technologies (autonomous, portable, not linked by a network) available to users at any location and any hour of day or night including cable television, interactive cable television, teletext, electronic publishing, broadcast satellites, videodiscs, computer-based technologies. The problem confronting those attempting to make a contribution to continuing medical education in the face of an information avalanche is how to select from among the increasing alternatives of communication technologies. Discusses the impact that these technologies will have or could on CME.

Byers DL, Hilgenberg CS, Rhodes DM. Evaluation of Interactive Television Continuing Education Programs for Health-Care Professionals. Journal of Educational Technology Systems 1995-96; 24(3): 259-270.
Abstract: Although many reports have evaluated interactive technology in distance learning, there is a lack of reports focussed on utilising interactive television to meet the adult continuing education needs of professionals. This study describes the evaluation of live two-way interactive television (ITV) continuing education programs for health-care professionals. The programs were evaluated using adult learning characteristics as the evaluative framework. Data collection consisted of surveys, interviews, and participant observation. Results indicate that these continuing education programs delivered through interactive television technology met the adult learning requirements of the health-care professionals who participated. The overwhelming majority of those in the sample indicated the interactivity of the system enhanced their learning and that they would be likely to attend future professional education programs offered via ITV.

Byers DL, Hilgenberg CS, Rhodes DM. Evaluation of Interactive Television Continuing Education Programs for Health-Care Professionals. J. Educational Technology Systems 1996; 24(3): 259-270.
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Caldwell KS, Brayton D. Use of Television and Film in Continuing Education in the Health Sciences. Journal of Biocommunication 1974; 1(1): 7-16.
Abstract: The history of the UCLA's Medical Media Network is examined in relation to he value of audiovisuals for use in continuing education in the health science. The evaluation studies are described in some detail; the development of the present program format and of auxiliary services is covered. It is the intent of the report to relate the experiences of one organization to the predications once made for the role of audiovisuals in continuing health sciences education and to draw conclusions from those experiences. Thus, a guide may be provided for the future of this form of education and repetition of mistaken premises may be prevented.

Cervinskas J. Telehealth: telecommunications technology in health care and health education in Canada. New technologies in Canadian education series. Paper 15. TV Ontario, Toronto. 1984. ED 323 984.
Abstract: This examination of the use of telecommunications systems in the health care field in Canada notes that the use of such systems to assist in the delivery of health care at a distance is critical to the remote and isolated regions of the country. The report begins by reviewing the development of "telemedicine" or "telehealth" systems using various combinations of telephone, cable, microwave, and satellite technologies. Examples of such systems are provided by describing three experiments with linking hospitals in remote areas with urban teaching hospitals. The remote hospitals were the Moose factory General Hospital in the northern district, the Sioux Lookout Zone of the northwestern Ontario, and four remote hospitals in Newfoundland. Technologies included linking via the Hermes satellite and/or slow scan television; applications ranged from medical diagnosis and consultation to administration, continuing education for health professionals, and

patient treatment. Current telehealth applications in Canada are then described, including programs operating in British Columbia, Alberta, Manitoba, Ontario, Quebec, New Brunswick, and Newfoundland. Issues involved in planning for telehealth programs are discussed, including whether video is needed in addition to audio, protection of patient-physician confidentiality, remuneration for services rendered via telecommunication, and the need for more expertise and guidance in creating the programs to be transmitted. A look at future direction for telehealth in Canada concludes the report.

Chang BL, Hirsch M. Videotape Intervention: Producing Videotapes for Use in Nursing Practice and Education. The Journal of Continuing Education in Nursing1994; 25(6): 263-267.
Abstract: The purpose of this article is to describe the process utilized to produce nursing-specific videotapes for application in clinical or educational settings. The three phases, pre-production, production, and post-production, are exemplified with the description of the process used by the authors as they developed the Nurseline Video-Assisted Modelling Program (NuVAMP), a video intervention for caregivers of people with dementia that helps them to shape family members behaviours in activities of daily living. The practical aspects of video production are emphasized, including script writing, budget development, and the video editing process.

Chouinard J. Satellite contributions to telemedicine: Canadian CME experiences. CMAJ 1983; 128: 850-855.
Summary: Canada became the first nation to develop a domestic telecommunications system with a satellite in geostationary orbit. Anik-A-1 launched in 1972, was placed in such a way that it could remain in the same position at all times, thereby providing reliable and continuous telecommunication services. Anik-A-2 launched in 1973, brought network radio, television and improved telephone services to the North, and Anik-A-3 launched in 1975 provided additional channel capacity. Working with the US, the two countries combined expertise to design and develop the communications technology satellite Hermes, when launched in 1976 became the world's most powerful communications satellite and was used for many technical trials of tele-education and telemedicine to Canada's northern, rural and remote areas. The advances with Hermes allowed the use of smaller, less expensive ground stations and made satellite services more accessible.

Clark CE. Beam Me Up, Nurse! Educational technology Supports Distance Education. Nurse Educator 1993; 18(2): 18-22.
Abstract: The Intercollegiate Center for Nursing Education (ICNE) has recently added a second technology to its earlier distance education program. Orientation of nursing faculty to effectively use the new two-way video and audio interactive

microwave system has been a challenge, and the reward for meeting that challenge is satisfied distance learners. The author discuss the planning, implementation, and evaluation of this new technology.

Clark CE, Cleveland TL. The Media and the Mode. The Journal of Continuing Education in Nursing 1984; 15(5): 168-172.
Summary: Broadcast television has been used to address some of the problems that nurses have in gaining access to available continuing nursing education because it brings learning opportunities to large numbers of nurses in their own homes and work settings. The Intercollegiate Center for Nursing Education (ICNE) produced videotapes for transmission over cable television systems as a means for providing continuing nursing education. ICNE had access to air time on a franchised educational television channel in Washington state and a 12-part videotape series entitled "Physical Assessment of the Young and the Elderly: Special Considerations and Techniques" was aired over cable television in four eastern Washington communities. It was estimated that 1,500 viewers watched portions of the series and upon completion of the series those who had enrolled it were asked to complete an evaluation. 85% liked the content and found the syllabus useful and felt the objective had been well met.

Clark CE. Telecourse for Nursing Staff Development. Journal of Nursing Staff Development 1989; May/June: 107-110.
Abstract: Instructional television is a viable option for meeting staff development needs in health care agencies. Telecourses produced by the Intercollegiate Center for Nursing Education provide staff development educators with an efficient and effective alternative for meeting selected educational needs of staff within health care institutions, as well as interested nurses throughout the community. Use of this instructional methodology is described.

Clarke LM, Cohen JA. Distance learning: new partnerships for nursing in rural areas. NLN Publications 1991 Nov (21-2408): 359-88.
Summary: The University of Vermont School of Nursing delivered an associate degree nursing program to licensed practical nurses in southeast Vermont via Vermont Interactive Television (VIT), an educational technology which brought the teacher and learner face to face and allowed interaction between them over long distances. VIT is a two-way audio and video link (compressed video). Compressed video was selected because the transmission medium, over telephone lines, is almost universally available and is environmentally acceptable to the state (as opposed to the high towers necessitated by microwave links). Students were introduced to the system by the site coordinator and because teaching via interactive television was a new experience for the faculty, an orientation program was provided. The major task

for the faculty was to learn to interact with the students who were not physically present. This paper documents the use of interactive videoconferencing for this distance learning project and offers an extensive background discussion on the history and theoretical foundations of distance education.

Dawes BSG. Can distance learning provide a twenty-first century hallmark? AORN Journal 1998; 68(2):170-174.
Summary: The uses of technology for learning offers strengths that some find encouraging. It can accommodate the lifestyles and work schedules of many nurses who desire formal learning opportunities and distance learning provides wider access to academic and continuing education. This paper defines and discusses distance learning and the opportunities it offers to nurses and nurse instructors including maximizing access to qualified instructors, freeing learners from traditional classroom settings, offering convenience, the ability to study on an independent schedule, and an opportunity for self-directed study. The authors also describes the various technologies which can be used to deliver distance learning programs - correspondence classes, audiotapes and videotapes, home study programs, satellite television, cable television, interactive and compressed video.

DeMuth JE. National pharmacy survey on the availability of hardware required for continuing education delivery systems. American Journal of Pharmaceutical Education 1991; 55(1): 36-39.
Abstract: Various delivery systems, such as audio and video cassettes, cable television and interactive computer programs, offer unique methods for providing continuing pharmaceutical education. To evaluate the availability of the required hardware to facilitate these types of programs a nationwide survey was conducted with a response rate of 51.0 % from a random sample of approximately 1% of US pharmacists. Results showed that over 90% of the respondents had available audio and video cassette playback units. Cable television offered the third most available system with 70.9 % subscribers and an additional 20.9% having these services within their neighbourhoods. Computers capable of running software that was evaluated for selected demographic variables. This information may be available to schools of pharmacy evaluating the development of innovative learning experiences for continuing education offerings, certificate programs and/or extended PharmD degrees.

Devaney S, Peterson SJ, Martin LK, Collier C. Continuing Health Education Via Interactive Television: A Pilot Project. Journal of Nursing Staff Development 1996; March/April: 98-100.
Abstract: Since its inception in 1952, the Missouri League for Nursing, Inc. (MLN) has offered continuing education programs for health professionals in Missouri. In

1983, a new executive director was hired, and MLN began to increase its offering. In 1982, MLN conducted 27 workshops in 190 locations, serving a total of 6,348 healthcare professionals. These numbers increased in 1993, and current projections for 1994 are for 27 workshop topics to be offered at 216 locations. The purpose of this paper is to describe a pilot project which used interactive television to provide continuing education on infection control to rural and remote nurses. 53 people attended the workshop and the number of participants per site ranged from 1 to 17. The results of an evaluation indicated that those in attendance believed they obtained appropriate information from the programs.

Dirksen SR. RN/BSN Distance Learning Through Microwave. Nurse Educator 1993; 18(2): 13-17.
Abstract: Audio and video interactive electronic classroom systems are one way to increase access to baccalaureate programs for working nurses who do reside near a degree-granting university. The authors describe the impact of this microwave television system on courses implemented in a registered nurse/bachelor of science in nursing program. They also discuss the implications for course design, teaching strategies, class interaction, and student achievement.

Dunn EV, Acton H, Conrath D, Higgins C, Bain H. The Use of Slow-Scan Video For CME in a Remote Area. Journal of Medical Education 1980; 55: 493-495.
Abstract: Since August 1977 a slow-scan video system has been operating in a remote area of northwestern Ontario, Canada. This system, using regular dial-up telephone lines, interconnects the local hospital, five remote communities, and two teaching hospitals in Toronto, 1,000 miles distant. Since August 1978 the system has been used on a regular basis for continuing medical education programs, graduate medical education including x-ray rounds, medical rounds, nursing rounds, in-service education, and patient education. These CME programs for physicians have been accepted for study credits by the College of Family Physicians of Canada.

Dunn EV, Fisher M. The use of freeze frame (slow scan) video for health professional education. Medical Education 1985; 19: 148-154.
Abstract: Continuing education in the professions is receiving increased emphasis and the economic and effective delivery of programmes must be a priority for the future. Freeze frame video, one of the newer telecommunication technologies, is a promising method for delivering continuing medical education (CME) over distance for those who have difficulty in regularly attending educational update programs, especially those in rural and isolated areas. The system uses two telephone lines to transmit both voice and a still picture simultaneously to one or several sites. The video portion can be a view of the patient, text, 35-mm slides, microscopic slides, or any other still object. Five years' experience with a slow-scan system as used for

education is outlined. Three types of program formats were all presented with this technology; consultations; discussion/case presentations; and lectures. The best use of the system was for small groups, with discussion of their unique problems. The fully interactive nature of the slow-scan system assisted in the presentations and allowed all sites in multisite conferences to be fully involved. Because most teachers are not familiar with the technology in their everyday life it requires more orientation and experience to accomplish a skilled programme than with other telecommunication systems such as the telephone or television.

Emery D. Education for nurses and midwives at a distance: using video and audio technology. Health Informatics 1994; 1(1): 10-14.
Summary: This article describes a project framework for the application of fibre optic technology to enable visual and sound images for continuing nursing education to be transmitted to an adult learner group situated in a distant location from the tutor. A live two-way and multiple-way video link was developed to enable interaction between the parties involved in the educational process.

Emory medical TV Network Offers Continuing Education to Medical Professionals. Technological Horizons in Education 1983; 10(3): 76.
Summary: Since 1967 the Emory Medical Television Network (EMTN) has provided medical institutions in the Atlanta area with educational programs through its ITFS (Instructional Television Fixed Services). ITFS is a closed circuit, two-way TV system that allows an audience in diverse remote locations to view, via TV, lectures and intricate demonstrations. The network is self-supporting and broadcasts 3 hours of live, full-colour programming Monday through Friday, year round to 34 medical institutions in the Atlanta area (medical grand rounds, pediatric rounds, cardiology conference, topics in medicine, and gyn-ob Rounds). This paper provides an overview and a history of the development of the Network.

Fahs IJ, Miller WR. Continuing Medical Education and Educational Television: An Evaluation of a Series for Physicians in Minnesota. Journal of Medical Education 1970; 45: 578-587.
Abstract: From 1967 - 1970, from early fall to early summer, an open-channel educational television series called "Monday for Medicine" was telecast Monday evenings from 10:00 to 11:00. Upwards of over 40 programs were broadcast during each season and they were produced by the University of Minnesota College of Medical Sciences and the Mayo Clinic, and other medical centres. An evaluation of the series was conducted in terms of accuracy and recency of scientific information, communicability, and relevance to a physician's care of patients.

Fairbanks J, Viens D. What's Happening: Distance Education for Nurse Practitioners: A Partial Solution. Journal of the American Academy of Nurse Practitioners 1995; 7(10): 499-503.
Abstract: Health professionals who live and practice in rural areas have limited opportunities to further their education. In order to pursue advanced nursing degrees, nurses have to leave their communities. A collaborative distance education project involving the University of New Mexico College of Nursing, the Area Health Education Center, and Western New Mexico University has provided a partial solution to this problem. Six registered nurses living and practicing in a rural site are now receiving their Family Nurse Practitioner degrees via two-way audio-video teleconferencing equipment. Distance education can improve the numbers of primary care providers in rural areas; however, projects will require extensive planning and resources.

Fielding DW, Dinning BCA. Delivering continuing education by satellite. Can Pharm J 1981; December: 452-454.
Summary: In the early 80s British Columbia had the opportunity to use space-age technology in its continuing pharmacy education activities. In cooperation with the federal and provincial governments, live educational programs were transmitted by the Anik B satellite to a number of communities throughout British Columbia. In this article the authors briefly discuss the following: why it is becoming necessary for continuing education providers to use distance education methods; British Columbia's experience with satellite programming for pharmacists; some of the special requirements associated with satellite programming; and the future use of satellites in continuing pharmacy education.

Fisch A, Dwyer TF. Interactive Television in the Continuing Education of Foreign-Trained Psychiatrists. Journal of Medical Education 1972; 47: 912-914.
Abstract: Bidirectional, interactive television (IATV) has been utilized as the vehicle to present psychiatric information to foreign-trained psychiatrists who were preparing for their specialty board examination. The major goals involved in this project were, first, to explore the use of interactive television in teaching by the small group method and, second, to assess the feasibility of conducting a postgraduate education course originating from a distant teaching hospital for busy foreign-trained clinicians.

Folberg R, Dickinson LK, Christiansen RA, Huntley JS, Lind DG. Interactive Videodisc and Compact Disc-Interactive for Ophthalmic Basic Science and Continuing Medical Education. Opthamology 1993; 100(6): 842-850.
Abstract: The authors designed and implemented a complete curriculum in ophthalmic pathology using IBM- and Macintosh-based interactive videodisc (IVD) technology. They also redesigned a portion of this curriculum for a new television-

based platform, compact disc-interactive (CD-I). The following issues were addressed: curriculum design, instructional design, the assembly of illustrations and the ownership of such materials, the generation of computer-based medical art and animation, and programming. The issue of academic credit for faculty participating in this effort also was considered. The computer-based IVD program provides the following features: (1) rapid access to thousands of high-quality illustrations with the option of superimposing graphic labels and text directly over pictures; (2) the ability to view enlargements of photographs; (3) an online glossary to view definition of terms coupled with high-quality phonographs; and (4) a dynamic introduction to pathophysiology using interactive animation sequences. The authors were able to incorporate the same interactive features into the CD-I version. High-quality medical illustrations can be used effectively on the CD-I platform. Computer-based multimedia workstations are relatively expensive for personal use but may be useful if the equipment can be shared in a learning centre or library. Compared with interactive computer-based solutions, consumer oriented television-based technology such as CD-I is a relatively inexpensive vehicle for providing continuing medical education programs intended for use on the individual practitioner's office or home.

Fry CF, Baer C, Cornett S. Interactive Television in Nursing Continuing Education. The Journal of Continuing Education in Nursing 1976; 3: 26-32.
Abstract: A telemedicine system is being used to teach nursing continuing education courses from an urban university medical centre to rural hospitals in Southeastern Ohio. This article describes the author's experience in using the two-way television system for a course in Critical Care Nursing.

Giegerich A. NPTV: On the Air. America's Pharmacist 1997; November: 17-20.
Summary: This article describes NPTV, the Neighbourhood Pharmacy Network which offers continuing pharmacy education and information for pharmacists and their patients. Each day NPTV brings up-to-date pharmacy news and information, marketing and management tips, legislative updates, and information that will help community pharmacists. The satellite broadcasts are to receive only sites (closed-satellite services). Pharmacists can sign up for NPTV and receive a 19 to 27 inch colour TV, a direct broadcast satellite system, and a VCR. Patient surveys during the pilot project suggest that nearly 95% of respondents found the programming useful and interesting

Gold RH, Kangarloo H, Yaghmai I, Grant EG, Stewart BK, Mankovich NJ, Sayre JW, Dwyer SJ. Teleconferencing for Cost-Effective Sharing of Radiology Educational Resources: Potential and Technical Development. AJR 1993; 160: 1309-1311.

Abstract: To develop a cost-effective method of sharing educational resources, a dial-up teleconferencing network was implemented between three radiologic sites for a 30-day period of evaluation. By means of standard dial-up telephone channels, compressed video and audio signals displayed radiologic images, slides, and text, allowing residents and faculty from the three sites to participate in sight and sound interactions. Each of the three sites used compressed video/audio coder-decoders (codecs) conforming to the Consultative Committee on International Telegraphy and Telephony H.261 standard. Four video cameras were used at each site, and the audio was run in full duplex mode. A multipoint video bridge was used to broadcast codec output signals to the input lines of the other codecs. Our evaluation found audio quality to be suboptimal, but capable of being improved; diagnostic image quality was adequate when a video zoom mode was used; the digital-archive mode of the codec proved advantageous; the H.261 codec permitted participation from all sites; and all conference lecturers were able to conduct their conferences as they were accustomed. Although audio quality and spatial resolution need to be improved, the results of this pilot study imply that dial-up compressed video conferencing has the potential to become a practical, cost-effective method of sharing educational resources by means of interactive radiologic multisite educational programs.

Grouse L, Rockwell T. AMA's "Medicine Today" TV Program. JAMA 1985; 253(17): 2558-2559.
Summary: AMA's national television series for physicians "Medicine Today" premiered on Jan 6, 1985 with the broadcast a part of Lifetime Medical Television's "Doctors' Sunday," a mini-network providing a full day of programs for physicians each week on the Lifetime cable television network. Content for these telecasts are derived from journals, scientific councils, and informational resources of AMA. The Lifetime Medical Television cable distribution reaches 24 million homes in the US including those of an estimated 180,000 physicians. According to the authors, television is an excellent method of disseminating simple messages rapidly and effectively. Medico-legal, economic and political events affecting medical practice have taken on a faster pace and with the increasing sophistication and knowledge of patients it is essential for physicians to keep abreast of current issues and events relevant to medicine. The one main disadvantage of television is that it is superficial - it is difficult to use television for lengthy exposition or the abstraction of complicated ideas or details.

Gruppen LD, Hutchinson SP, Gordon PJ, Roser S. An Evaluation of the Efficacy of Interactive Videoconferencing in Residency and Continuing Education. Academic Medicine 1996 Jan; 71(1 suppl): S7-9.
Abstract: This study reports the results of an evaluation of the effectiveness of videoconference broadcasts on topics in oral and maxillofacial surgery. The results of the evaluation suggest that educational videoconference broadcasts can have a

substantial impact on the knowledge and attitudes of oral and maxillofacial residents, faculty, and practitioners. The level of preprogram knowledge indicated that the topics which were selected would be beneficial (surgical management of naso-orbitoethmoidal (NOE) injuries and the treatment of severely atrophic maxilla (SAM)), and participants showed statistically and educationally significant increases in knowledge attributable to the broadcast. The broadcasts also increased the confidence of all participants in their knowledge of and ability to treat NOE and SAM. Participants rated the satellite broadcast as more effective than traditional methods (lectures and teaching rounds) and they indicated they would be willing to participate in another broadcast program.

Hammond LM, Hannah KJ. Delivering Continuing Nursing Education via Interactive Satellite Television. AARN 1989; February: 27-28.
Summary: The authors describe a project which occurred in 1985 involving the delivery of continuing nursing education in Alberta via the interactive satellite television network known as ACCESS. The ACCESS network, a crown agency funded by the Alberta government (with an agreement with Telesat Canada) has a dedicated responder on the Anik C3 satellite and the signal covers Alberta, BC, Saskatchewan and Manitoba. The nursing viewing audience could phone in messages or questions to the presenters.

Hampton CL, Maxmanian PE, Smith TJ. The Interactive Videoconference: An Effective CME Delivery System. The Journal of Continuing Education in the Health Professions 1994; 14: 83-89.
Abstract: Today satellite television is readily available to many hospitals, where it can provide an efficient means of delivering continuing medical education (CME) - particularly in rural areas. Since there is little research in CME on the effectiveness of videoconferencing, this paper was written to describe a case study focussing on that issue. An interactive videoconference on breast cancer was presented to health care professionals in their community hospital setting. Results of a test given before and after the broadcast indicated a 21 percent increase in knowledge among participants.

Havice PA, Knowles MH. Two-way Interactive Video: Maximizing Distance Learning. The Journal of Continuing Education in Nursing 1995; 26(1); 28-30.
Abstract: The challenge of providing continuing education courses in a timely manner is becoming increasingly difficulty because of the rising costs in travel and presentation materials. Two-way interactive video (TWIV) presents an opportunity for delivering programs in a user-friendly, affordable, and convenient way. This article covers the history of two-way interactive video (TWIV), the necessary

equipment for a TWIV classroom, significant research findings and uses for TWIV. Also discussed are ways of using TWIV to enrich the practice and art of nursing.

Haynes P. Telehealth and videoconferencing: What is the difference in Distance Education? Studies in Health Technology & Informatics 1998; 51: 166-169.
Abstract: Education for health professionals can be divided into three main sections: basic preparation, continuing education to advance knowledge, and continuing education to remain competent. Basic preparation occurs in schools, colleges and universities, advancing knowledge may be through participation in conferences and graduate educational programs and remaining competent is an attitude of lifelong learning that can occur anywhere and at any time. Books and journals have been the primary resources for these activities for decades, and then we acquired new sources: sound (radio, records and telephone), vision (television and videotapes) and more recently computers and the Internet. In the Faculty of Nursing at the University of Alberta we have had the opportunity to use two of these systems. Digital videoconferencing has been used for distance delivery of courses in the basic nursing program and Telehealth has been used as a n adjunct to courses in the undergraduate program and is being used also for aspects of continuing education. Telehealth is the name given to a system that combine audio, visual and computer technologies and in the literature is frequently referred to as Telemedicine. At the University of Alberta we have opted for the term Telehealth because our site is interdisciplinary and we are exploring avenues of use outside of those strictly within the domain of the discipline of medicine.

Hegge M. Interactive Television Presentation Style and Teaching Materials. The Journal of Continuing Education in Nursing 1993; 24(1): 39 -42.
Abstract: Special teaching techniques and presentation styles are required for an effective telecourse. This article describes modification of a traditional graduate nursing course for televised delivery to remote students. Teacher appearance and behaviour as well as student activities for telecourses are proposed.

Henderson FC. Video-Teleconferencing in Nursing. NLN - Publications 1985; Sep 41: 32-38.
Summary: This article describes the hardware which is needed to operate a video teleconferencing system for distance learning. The author discusses the advantages and disadvantages of video teleconferencing, including the various peripheral media devices which can be utilized to deliver multimedia information. Suggestions and recommendations for enhancing the quality of instruction delivered through this medium are identified and an overview of several projects involving the use of the technology are presented.

Hensley BK, Palmer RI. The Mountain Goes to Muhammed: Broadcast Television for Continuing Education in Nursing. JCEN 1975; 6(5): 38-46.
Abstract: To meet the needs of North Carolina nurses for leadership training as well as their need to have continuing education in their local community, the Continuing Education program of the School of Nursing designed a course in leadership using the medium of broadcast television combined with direct instructor contact. Phase I prepares a group leader to coordinate Phase I in the local setting. Phase II is a series of ten two-hour classes in the participating home agency consisting of ½ hour of televised input - lecture, quizzes, dramatic vignettes and graphics combined with 1 ½ hours of practice which is guided by a workbook.

Hoeksel R. Clinical Nursing Education at a Distance: Solving Instructor Interaction Problems. Journal of Nursing Education 1994; 33(4): 178-180.
Summary: The purpose of this paper is to describe the experience of establishing faculty coordination and collaboration in teaching combination theory and clinical courses over a two-way interactive microwave television system. ICNE (The Intercollegiate Center for Nursing Education), a consortium school of nursing shared by Eastern Washington University Washington State University, Whitworth State University, and Whitworth College collaborated to begin offering nursing classes to RN-BSN students at a distance. ICNE was able to offer nursing classes simultaneously to this student population via an interactive electronic classroom system linked to the Washington Higher Education Telecommunications System (WHETS) - an interactive television technology system. The author describes the system, the technology used, and shares experiences in planning and implementing a distance learning program for rural nurses.

House AM. Telecommunications in health and education. CMAJ 1981; 124: 667-668.
Summary: For some years educational programs have been provided to students at a distance through correspondence courses, audiotapes, videotapes and limited use of public radio and television. These all have a major shortcoming: they do not provide the opportunity for immediate interaction between student and tutor. For more than two decades physicians and other health care professionals in the US and Canada have been exploring the use of interactive live television techniques to link isolated with more central areas for consultations, transmission of medical data and, to a limited degree, for education. This paper outlines some of these initiatives.

Houston H, Beck L. Distance learning package for eye disease. British Journal of General Practice 1995; 45(395): 325.
Summary: In this paper the authors discuss the application and evaluation of a distance learning package on eye disease for general practitioners. The package

consisted of videotape material (demonstrating clinical method and physical signs) and an accompanying book (facts, knowledge and reference material). The course evaluation did show a marked increase in knowledge (31.1% increase) from pretest measures. The authors feel that the course was successful because it was related to real need and because it was available in a format which suited the learner.

Hunter AT, Portis B. Medical Educational Television Survey. Journal of Medical Education 1972; 47: 57-63.
Abstract: For several years, the Faculty of Medicine at the University of Western Ontario has conducted a continuing education program directed toward approximately 2,200 medical doctors in southwestern Ontario. The area has six metropolitan centres but also includes rural communities where there are physicians practising as far as 150 miles from the main university campus. The authors postulate that CME by broadcast television might attract a larger audience than was being reached by the traditional forms of instruction. It seemed reasonable that television could overcome the problem of distance and travel, permitting the doctors to watch instructional programs in the convenience of their own homes. A pilot series of five programs was broadcast in 1966 to determine whether any interest in CME by broadcast television existed in the district and whether there was likely to be any serious resistance to such an undertaking. A cursory evaluation of this series indicated that it was worthwhile to continue with an expanded schedule of television broadcasts.

Jarrett C, Wainwright P, Lewis L. Education and Training of Practice Nurses. Journal of Telemedicine and Telecare 1997; 3(1): 40-42.
Abstract: Seventeen nurses in eight rural general practices participated in a distance education project. Low-cost videoconferencing equipment was assessed for its suitability in two training sessions, concerning asthma and travel immunization. The intended learning outcomes were reached and although initially apprehensive, the nurses quickly became accustomed to the medium. Videoconferencing has now become an accepted part of in-service training. Technical reliability remains the most important problem.

Kalisman M, Wendorff ER, Millendorf JB. Video Conferencing and Real-Time Communication. Clinics in Plastic Surgery 1986; 13(3): 497-507.
Summary: Videoteleconferencing involves interactive communication via electronic media between groups of people in which speech, visual images, and messages are exchanged electronically by participants who may be relatively nearby or extremely far apart. Videoteleconferencing will make it easier for the physician to keep abreast of current and rapidly evolving medical developments. The authors describe and discuss the use of slow scan video, which works over normal telephone lines, and

interactive videoconferencing systems. Slow scan (freeze frame) video can take an image from a television camera, freeze it in stop-action one frame at a time, and then transmit it at the command of the operator, resulting it a clear, sharp, video image, it is detailed enough for a doctor to read x-rays and for a radiologist to examine a CAT scan. Videoconferencing systems allow the instant presentation of numbers, charts, graphics, x-rays, and CAT scans. The article discusses the hardware which is needed to operate and implement both technologies.

Kaminsky AS, Isaacs S. A Circulating Medical Library on Videocassettes. Educational & Industrial Television 1977; March: 41-44.
Abstract: In March, 1967, the Emory University School of Medicine in Atlanta, Georgia began televising with a small ITFS system. Its programs were black-and-white, and were beamed to six hospitals within in a 25-mile radius of the studio in Grady memorial Hospital. Today, ten years later, there are 30 institutions in Atlanta that receive live color broadcasts for approximately three hours a day, five days a week, on two ITFS channels. The network is one of the nations's largest distributors of medically-oriented television programs through its circulating tape library.

Kaufman DM, Brock H. Enhancing Interaction Using Videoconferencing in Continuing Health Education. The Journal of Continuing Education in the Health Professions 1998; 18: 81-85.
Abstract: Health professionals employ many methods for meeting their continuing education needs. However, one essential element needed to change practice behaviour, and consequently patient outcomes, is the use of teaching approaches that provide interaction among participants and the instructor. These interactions should be situated in a clinical context that is relevant to participants. Videoconferencing links an instructor and participants at various remote sites using audio and video communication. A number of programs that use videoconferencing in health education have recently been described in the literature. All of these programs report that this medium has been well received by participants and is a viable alternative for delivering continuing education. There are many reasons why videoconferencing can be justified. It permits rural health professionals to participate in educational events without leaving their communities, and allows specialists at academic centers to reach learners in many remote communities in a relatively cost-effective manner. However, new approaches to teaching need to be employed with this medium. This paper describes a workshop delivered at the Annual Meeting of the Alliance for Continuing Medical Education. This workshop was based on a mini-case, followed by two questions: (1) Why would a 2-hour lecture with slides be inappropriate for videoconferencing? and (2) What specific changes would you make in designing this sessions? Several practical techniques are presented for conducting successful videoconferencing sessions.

Langille DB, Sargeant JM, Allen MJ. Assessment of the Acceptability and Costs of Interactive Videoconferencing for Continuing Medical Education in Nova Scotia. The Journal of Continuing Education in the Health Professions 1998; 18: 11-19.
Abstract: We carried out continuing medical education (CME) using interactive videoconferencing to four communities in Nova Scotia, two rural and two urban, using room-based and PC PictureTel technology. Programming was decided upon by the target audience, developed by members of the Faculty of Medicine at Dalhousie University, and delivered from a broadcast studio at the University to physicians at their community hospitals. Faculty were provided support for their introduction to this medium in the form of a 1-hour training session. Each community received approximately 12 hours of CME. Participating physicians and faculty were enthusiastic in their responses to their involvement in CME programming. Program content was highly evaluated by almost all participants, and 72% felt that the format was as effective as face-to-face CME. Difficulties included those related to the technological aspects of programming, with participants agreeing only 65% of the time and faculty agreeing 70% of the time that the picture quality was satisfactory, while 90% of participants felt that it was satisfactory. Since PC-based units were able to operate with only two Centrix lines at 112 kilobits per second, and since these sites operated simultaneously with others, limiting bandwidth for all participants, these difficulties are amenable to technological improvement. Focus group analysis found that removal of barriers to attendance at traditional CME, particularly lost time from practice and family and distance to travel, was valued. This was most marked for rural physicians.

Latchem C, Rapley P. Trial by satellite: Video conferencing for continuing education for rural area nurses. Distance Education 1992; 13(1): 118-130.
Abstract: In 1990, the Curtin University School of Nursing trialed seven continuing education sessions for nurses based in three sites in Western Australia's north-west. Delivery was via LIVE-NET, a compressed video conferencing network operating through Telecom's Iterra satellite service. The following paper describes the network and discusses the results of a survey conducted into the rural area nurses' assessments of the physical presentation and interactive communication within the sessions and the suitability of this medium to continuing education for nurses.

Levy BT, Albrecht MS, Gjerde CL. Using Video conferencing to Train Community Family Medicine Preceptors. Academic Medicine 1998; 73(5): 616-617.
Abstract: Since the third-year Family Medicine Preceptorship at the University of Iowa College of Medicine began in 1979, we have required community preceptors to attend an initial half-day faculty development workshop and to update their training periodically. We have traditionally taught three workshops at various sites in Iowa each year. Although attendance required considerable travel time, the preceptors interest was high. Completion of the Iowa Communications Network (ICN), an

interactive video conferencing system, offered an alternative delivery mechanism. Our objective was to conduct preceptor training using the ICN and to assess the quality and convenience of the workshop.

Lewis BJ, Levinson L. Hi-Tech Education: Teleconferencing in a Hospital Setting. Journal of Healthcare Education and Training 1989-90; 4(3): 28-31.
Abstract: The video teleconference is the educational tool of the future, but it is not as simple as setting a student in a dark room and turning on a machine. Staff development educators will want to use the ideas in this article to initiate, market, and adapt the teleconference to fit the student's real educational needs. The purpose of this article is to share the authors' personal experiences in the development of this new service in a hospital environment. Benefits included improved education opportunities for physicians, nurses, and other allied health professionals. Teleconferences present national experts discussing current and pertinent information, reducing educational expenditures for travel, lodging, meal expenses, and provide a new community service opportunity in which the satellite reception system can be rented.

Limon S, Spencer JB, Henderson FC. Video-teleconferencing by Nurses - for Nurses. Nursing and Health Care 1985; 6(6): 312-317.
Summary: This paper describes a project which utilized interactive video-teleconferencing for providing continuing nursing education. Interactive video-teleconferencing combines the motion of live television with the familiar interaction of the telephone. Geographically isolated nurses can exchange ideas and information while keeping travel, lodging, and conference registration to a minimum. Conference participants who made up the audience at the origination site enjoyed the opportunity of participating in the conference while seeing it live and remote viewing sites were in one-way visual communication and two-way audio communication with the origination site via satellite and telephone. The authors make several recommendations for planning, organizing, implementing, and evaluating video-teleconferencing programs for nurses.

Lorensen M, Schei B. Higher Education via Satellite. Int. Nurs. Rev 1992; 39(5): 153-157.
Abstract: With the rapid advances in health, medical and technological fields, there is a pressing need for more nurses to obtain higher university degrees and continuing education in order to deliver quality care. Advanced education is necessary for not only nurse teachers but also clinical nurses. Yet, access and familial duties often impede further study. This paper reports on how Norwegian educational bodies solved the problem of reaching and teaching nurses throughout the country.

Lorenzi NM, Kues JR, Anthony SS. Beyond the Library Walls. Bull.Med. Libr. Assoc. 1984; 72(1): 1- 5.
Abstract: The Telecommunications Information Network (TIN) was an applied research project that evaluated the ability of slow-scan television to provide medical information on demand to health-care professionals at hospitals far from any urban area. This paper reviews the TIN project, describes its use, and discusses system advantages and disadvantages. System evaluation encompasses: (1) project benefits; (2) technical barriers to implementation and utilization; (3) the replication of services and the technology utilized; and (4) cost factors.

Mackin J. Educational Technology: The Basics and Beyond. Nursing Staff Development Insider 1992; 1(2): 3-5.
Summary: This article outlines how nursing staff development is offered through the American Hospital Association and the AIDS Satellite Television using commercial health education satellite networks to which hospitals can subscribe. Such companies include the Health and Science Network (HSN) and Health Care Satellite Broadcasting.

Mackin J. Video Programs. Nursing Staff Development Insider 1992; 1(3): 2-3.
Abstract: Reports on innovations in methodology and technology that support independent learning, including such topics as learning packages, videos, computer-assisted instruction, and learning centers. These issues are explored from a variety of perspectives - the facilitator's, the administrator's, and the learner's. The column also reports on the experiences of other nurse educators. Actual practical experiences in setting up a learning center, developing learner materials such as videotapes and learning packages, and converting traditional educational programs into learner-cantered models will be described.

Marshall CL, Alexander R. Improving the Use of Television in Continuing Education. Journal of Medical Education 1972; 51: 945-946.
Abstract: Scrutiny of the literature describing CME projects utilizing television reveals that these efforts were mounted without much attention to what could be learned from them, and, as a result, we know too little about the benefits of television to use it optimally and too little about its drawbacks to avoid them.

Martin JS. Television at the Mayo Clinic. Educational and Industrial Television 1976; 8(6): 26-27.
Summary: This paper describes a project which established a microwave television connection between the Mayo Clinic and other medical groups in nearby communities. CME programs were scheduled from noon to 1:30 pm on the last

Friday of each month and audiences included approximately 100 physicians and 90 - 100 nurses. During each program, each distribution point is connected to Mayo by an amplified conference telephone so that the viewing audience can have active participation in the programs. Formal evaluation concerning attitudes toward using television for CME and the amount of cognitive gain from the material presented revealed a positive, enthusiastic attitude toward the programs, and the physicians do learn from programs that are interesting and relevant.

McAlindon MN, Smith GR. Repurposing Videodiscs for Interactive Video Instruction: Teaching Concepts of Quality Improvement. Computers in Nursing 1994; 12(1): 46-56.
Abstract: The purpose of this study was to develop an interactive video instruction (IVI) program to teach registered nurses in the clinical setting concepts of quality improvement and to test the effectiveness of the program. The Smith Author System was used to combine text and video sequences repurposed from videodiscs developed for nursing education to describe and illustrate concepts of quality improvement. A sample of 55 registered nurses from a midwest regional medical center who used the program had a significant increase in knowledge ($p<.05$) from pre to postprogram opinionaire. More nurses with baccalaureate degrees scored above the median for the interactive video instruction program than those with associate degrees or diplomas. Registered nurses with more than 5 years of experience also expressed willingness to apply the concepts of quality improvement to their daily patient care activities and to use computers for learning.

Miller GE, Harless WG. Instructional technology and continuing medical education. Academy for Educational Development, Washington, D.C. 1970. ED 039 762.
Abstract: How has continuing medical education fared under instructional technology? For this reappraisal, the authors review the use of tapes, slides and film, in the medical professions in the US and in the British Isles, radio and telephone, television, programmed instruction, and computers (in their three-fold functions as retrievers of information, consultant in the diagnostic process, and instrument of instruction). Medical educators, the authors conclude, have embraced instructional technology with enormous enthusiasm, but have not done it systematically, seeming to have replaced their customary spirit of inquiry with a spirit of faith. They have neglected the process of diagnosing their needs, following it up with a specific prescription to correct the diagnosed defect, and a careful observation to determine whether the intervention has been effective.

Millonig VL. Television: An Alternative Delivery Method in Continuing Education. The Journal of Continuing Education in Nursing 1988; 19(2): 54-57.

Summary: The use of cable television as a new instructional method is a creative, cost-effective approach that can meet the continuing education needs of the professional nurse in a way that has not been used extensively in the past. For the nurse who is faced with decreased funds for continuing education the use of cable television is a logical alternative. This article focuses on the multitude of factors involved in the production of cable television continuing education programs. The elements considered include the preliminary planning process, selection of faculty, production, preparation of scripts, and the use of graphics. Other aspects which are addressed encompass production of elements such as tapes, cameras, teleprompters, and faculty characteristics.

Moore KHP, Brouwer KLR, Joyner PU. Lessons gained from distance delivery of an applied pharmacokinetics course. American Journal of Pharmaceutical Education 1997; 61: 310-313.
Abstract: Applied Pharmacokinetics was delivered to 54 University of North Carolina external doctor of pharmacy students during the Spring semester of 1996 using a combination of printed material, videotapes and interactive videoconferences. Live interaction was available via videoconference, during faculty visits to regional sites and by toll-free telephone conversations. This paper describes the course design, course materials, methods of communication and lessons learned during the Spring of 1996. Feedback regarding the course was obtained via a questionnaire administered to students at the completion of the course. Eighty-one percent of the students reported that videotapes were an effective method for delivery of pharmacokinetic course material. One-hundred percent of responders thought the course pack was a helpful supplement. Seventy-five percent of the responders wanted more interactive videoconferences. Development and delivery of an effective course for distance learners is an educational challenge that requires careful planning and a team effort.

Moore MA, Coker N. In a TV Age: ACLS Through Teleconferencing. JEMS 1992; September: 65- 68.
Abstract: Texas Tech MEDNET is a regional teleconferencing system designed to help rural health care providers overcome their sense of professional isolation through the use of satellite television and computer technologies in order to provide continuing education, patient consultation and health care information to providers who work in rural locations. 46 rural hospitals in Texas and New Mexico can view live continuing education programs via satellite television which originate at the Texas Tech health Sciences Centre. Ongoing programming consists of 12 programs each month (4 each for physicians, nurses and allied health professionals including EMTS and paramedics). ACLS training has also been provided through MEDNET to rural hospital staff. This paper provides an overview of experiences with the MEDNET program.

Moore RL, Shannon MS. Meeting Needs for Continuing Education through Advances in Technology. Lifelong Learning: The Adult Years 1982; February: 4-6. *Summary:* The focus of the study was on the use of video continuing education programs by colleges and schools of pharmacy. A telephone survey of designated heads or directors of continuing education at 73 colleges of pharmacy was conducted (88.9% of total pharmacy population). The findings indicated that only 7.8% of schools were producing video programs for CE and 29.7% of institutions indicated they were using video program in CE. Most were reluctant to entrust teaching to the videotape alone as a single method of instruction and many colleges of pharmacy have not generally used educational technology to extend their CE programs. Where video programs have been used they have enjoyed reasonable success.

Nichols EG, Beeken JE, Wilkerson NN. Distance Delivery Through Compressed Video. Journal of Nursing Education 1994; 33(4): 184-186. *Summary:* The use of telecommunications to deliver courses, and even complete educational programs, is becoming increasingly popular. The advent of relatively inexpensive compressed video systems that permit two-way video and audio interaction has increased this acceptance of distance delivery modalities in situations where face-to-face instruction is the previously established norm. As with the introduction of any innovation, there are always questions of effectiveness, comparability, and acceptance. This study examined the academic achievement and satisfaction of students in two nursing courses delivered via compressed video technology. The results indicated that students achieved to equal levels when courses were offered using distance delivery modes and social interaction was shown to be promoted. The authors suggest that methods (orientation) of introducing students to the technology in ways that enhance the education for all students must be developed.

Nierenberg J. New Technology for Educating Nurses. The Journal of Continuing Education in Nursing 1987; 18(1): 17-19. *Summary:* This paper provides an overview of satellite television and interactive videodiscs as means for delivering continuing education at a distance. Satellite television is a delivery system in which the programs are transmitted via satellite and received by a dish rather than by your rooftop antenna or via your cable network. Advantages of satellite television include decreased cost of travel, elimination of the stress of travel, many more educational opportunities in a given institution, and the ability of large and small hospitals to have access to the same subject matter experts. Interactive videodisc combines computer technology and video to create a highly interactive, engaging medium which is fun to use. The advantages of interactive videodisc include learner control of the pace and sequence of the content, an active learning experience rather than the traditional passive experience, the learning programs are available around the clock, and provide immediate feedback for responses.

Phillips CY, Hagenbuch EG, Baldwin PJ. A Collaborative Effort in Using Telecommunications to Enhance Learning. The Journal of Continuing Education in Nursing 1992; 23(3): 134-139.
Abstract: A consortium of three educational institutions was developed to respond to a possible need for educational programs in the workplace through teleconferencing technology. Based on survey findings, a pilot project of three educational programs was presented. Evaluation of the adequacy of such programming indicated its success in the use of such technology. The effort was unique because there was unprecedented collaboration among nurse executives, nurse educators, the Pennsylvania Nurses Association, the Hospital Association of Pennsylvania, and WITF, the publicly owned telecommunications center.

Piga A, Graziano F, Basconi R, Giuseppe MD, Cellerino R. Continuing Medical Education through the Videotex System in Italy. Journal of Cancer Education 1995; 10(4): 203-206.
Abstract: Continuing education for medical doctors is not compulsory in Italy. The link with the university is lost shortly after the final medical examination, and there is no other teaching institution for structured continuing medical education (CME). Distance learning gives physicians the opportunity to use updating programs at home at their convenience. Videotel, the Italian videotex system, is the first telematic tool that, at low cost, can reach every home nationwide. Through this system information can be exchanged 24 hours a day, using the Videotel database as central memory, the telephone network as connecting system, and low-cost devices as peripherals. The authors evaluated the technical capacity and didactic efficacy of the Videotel system as a vehicle for CME (in both oncology and general medicine). In an exploratory phase they surveyed physicians of the Italian Province designated for the study, with the objective of promoting the initiative and enrolling physicians interested in this innovative approach to CME. Teachers at Italian universities provided the educational material: interactive lessons, clinical case discussions and problem solving, and multiple-choice questions. Twenty-nine physicians agreed to participate. Despite the interest shown by these physicians, they made very little use of the didactic database. The main reasons for failure to connect with the educational database were the lack of time and unfamiliarity with the instructions. Although the results of the study were discouraging, the authors believe that the resolution of technical problems with the system and an increasing familiarity of physicians with telematic and informatic tools in general, together with appropriate incentives, will make the videotex system a feasible, low-cost, efficient vehicle for CME.

Premi J, Shannon SI. Randomized Controlled trial of a Combined Video-Workbook Educational Program for CME. Academic Medicine 1993; 68(10): s13-S15.

Summary: The purpose of this study was to examine the effect of an innovative CME program on physician's knowledge of the diagnosis and management of a patient with chest pain. The objective of the program was to enhance the participant's problem-solving skills through a presentation of data from a patient's history and a videotaped portrayal of a specific clinical problem. The participant uses these tools to develop a rational approach to the diagnosis and treatment of the patient. It was expected that information acquired as a result of the clinical experience derived from the tape would be more meaningful and therefore better retained by the learner than would information presented in the traditional disease-related format. 40 physicians wererecruited, randomly selected and assigned to an intervention or control group. There was a significant increase in the posttest scores for those who used the program compared with the scores of those in the control group.

Ranstrom C. Restructuring Interactive Television: An Educator's Perspective. Nurse Educator 1997; 22(1): 5.
Summary: This paper identifies several techniques for enhancing the quality of instruction which is delivered through interactive television. Several of the recommendations made by the author include having students at various receiving sites meet one another before beginning broadcasts, providing ample orientation time to students and faculty to become familiar with a variety of equipment that may be foreign to some, nurse educators who teach via ITV must be skilled teachers, and facilitators at various sites are necessary to maintain learning activities that focus on group work and to act as advisors.

Rasmussen TA. Keeping Pace: Video Communications in a Managed Care Environment. Managed Care Quarterly 1998; 6(2): 36-42.
Abstract: A number of health care provider organizations, particularly those with geographically dispersed personnel, are utilizing the video medium to improve organizational performance. The key attributes of the video medium are uniformity of education delivery to multiple sites, the ability to deliver information in a timely manner, the ability to visually portray best practices for all to see, and the convenience for end-users. While the executives interviewed for this article aren't aware of any published research specifically documenting he linkage between video education and improved organizational performance, the panelists believed that informed health care professionals inherently contribute to improved organizational performance and that video education is a prudent investment of resources.

Reiss J, Cameon R, Matthews D, Shenkman E. Enhancing the Role Public Health Nurses Play in Serving Children with Special Health Needs: An Interactive Videoconference on Public Law 99-457 part H. Public Health Nursing 1996;13(5): 345-352.

Abstract: Public Law 99-457 Part H supports the development of systems to identify infants and toddlers with special needs and provide these children the comprehensive care they need. Although public health nurses traditionally provide many of the mandated services, Part H, with its roots in education, presents new terminology, conceptual models, and challenges to public health nurses. An interactive videoconference entitled "Public Health Nurses and Part H: Putting the Pieces Together" was broadcast to 525 public health nurses in 11 states. The program goals were to increase knowledge of Part H among public health nurses and to enhance their role in its implementation. An evaluation was conducted to assess knowledge change and satisfaction with the program format. Results revealed a high degree of satisfaction with distance learning and no difference across sites in knowledge acquisition or participant satisfaction. A need identified through this project is increased interdisciplinary communication among those who serve infants and toddlers with special needs. In an era when financial resources are dwindling, interactive videoconferencing is an innovative and cost-effective method for decreasing the isolation of many public health nurses by offering opportunities for education and networking for their local communities.

Ribble JG, Moore RL, Bailey AR. Symposium: High Technology at Low Cost: Three Models of Teleconferencing in Continuing Medical Education. Proceedings of the Annual Conference on Research in Medical Education 1983; 22: 254-260.
Summary: This paper discusses the use of various communications technologies for providing continuing medical education at a distance. The authors provide an overview of the use of two-way radio in the 1950s by Frank Woolsey at Albany Medical College, the use of narrowband telephony for CME in 1965 by Thomas C. Meyer at the University of Wisconsin-Madison, and a project by the Association of Hospital Television Networks (AHTN) which used a public broadcasting radio station in Pittsburgh, Pennsylvania to provide continuing education for health care professionals. AHTN encompasses 35 major health care networks including 15 medical schools and reaching over 1200 affiliated institutions. The paper discusses the strengths and weaknesses in the various technologies for delivering continuing education.

Rosner E, Gould B, Gaschler L, Howard S, Rarick B. Evaluation of a Satellite Educational Program. Clinical Laboratory Science 1996; 9(1): 30-34.
Abstract: This study describes an evaluation of the effectiveness of an educational program which used a combination of live satellite programming and individualized instruction. A secondary goal was to develop an evaluation strategy that would be useful to other educators who provide distance-based educational programs. A program was designed for public health officers who would serve as laboratory directors in local public health laboratories. The course emphasized good laboratory practices as needed to direct a laboratory performing moderate complexity tests.

Physicians who completed the courses received continuing education credit and qualified as laboratory directors under the Clinical Laboratory Improvement Amendments of 1988. Participant satisfaction levels in areas ranging from quality of the video transmission to meeting the course objectives were favorable. Participants demonstrated a significant gain in scores on a test given before and after the course. Problem-solving exercises posed during the telecast demonstrated that the participants were actively involved and had completed the self-study material. A sample of participants surveyed several months after the course indicated that many had applied the course materials in their workplace. Distance-based education using a combination of interactive videoconferencing and self-study material can be a useful tool to enhance the cognitive skills for geographically diverse group of individuals. If carefully planned in advance, evaluation for distance-based educational programs can provide information that verifies the effectiveness of the program.

Sanborn DE, Sanborn CJ, Seibert DJ, Welsh GW, Pike HF. Continuing Education for Nurses via Interactive Closed-Circuit Television: A Pilot Study. Nursing Research 1973; 22(5): 448-451.
Summary: A pilot study was designed to determine the acceptance of interactive, closed-circuit television as a medium of continuing education for registered nurses. Nurses at the Medical Center Hospital (Vermont) continued their education as they always had (face-to-face), while nurses at the Central Vermont facility interacted via the television network. At the end of the nine-week series nursing audiences were administered an attitude rating scale to determine their reaction to the programs as a whole. Participants were also asked several questions directed toward interaction and participation. Both groups had the same attitudes toward the programs, 85% indicated they would not have participated more if they had attended the program in person, 91% stated that they would not have participated further if additional microphones were available, and 76% believed that TV posed no obstacles to their learning. This study indicates that an interactive closed-circuit system is amenable to learner participation.

Sanders J, Brucker P. Using Telemedicine for Continuing Education for Rural Physicians. Academic Medicine 1995; 70(5): 457.
Summary: This article describes a project in which a telemedicine consultation served as the basis for providing individualized, clinically-based, one-on-one CME to physicians at a distance. The telemedicine CME program of the Medical College of Georgia enables rural physicians to enhance their ability to care for their patients. Typically, the project involved a referring physician asking for a consultation from a specialist on patients who had difficult diagnosing or managing a patient problem. Using telemedicine the referring physicians and their patients were present during an interactive consultative examination. Following the clinical examination and

evaluation, the consulting and referring physicians discussed the patient's problems and developed a follow-up or management plan. Referring physicians were granted CME credit for the one-on-one teaching that took place.

Savela E, Lilja J, Enlund H. Continuing Education by Teleconference to Remote Areas. Journal of Social and Administrative Pharmacy 1996; 13(3): 159-166.
Abstract: The availability and quality of continuing education are crucial aspects in maintaining skills and developing the practice of pharmacy. In this study we evaluated the use of teleconferencing as a means for continuing education and to obtain information for the future development of this kind of education. The study data comes from three separate educational ventures held in 1990-92. Besides ordinary lectures via two-way teleconference transmissions to several sites in Finland, video films and group work were also used. A questionnaire was given to the participants both before and after the events. A total of 92 participants returned the questionnaires. In the first year, the participants did not find television-mediated education, video education or group work as attractive as traditional lectures, but the situation changed during subsequent years. Before the educational event, the participants from the satellite sites gave higher value to video and television education, whereas afterwards the participants from the central site were more content with the lectures and videos. Concerning group work, the results were exactly the opposite. The participants' attitudes towards teleconference education changed mostly in a positive direction. If the technology is available, the use of teleconferencing offers a good alternative for continuing education to most areas.

Sen Cupta TK, Wallace DA, Clark SL, Bannan G. Videoconferencing: Practical Advice on Implementation. Aust. J. Rural Health 1998; 6: 2-4.
Abstract: Videoconferencing provides a useful tool for improving information flow, with clinical, educational and administrative uses being particularly relevant to rural and remote Australia. This paper describes the range of possible uses for computer-based videoconferencing and describes the authors' experience in delivering rural medical education in North Queensland via videoconference. Principles that ensure successful videoconferencing are outlined and are applicable to a variety of formats and uses. They include the need to keep it simple, the importance of thorough preparation, and ensuring that education drives technology, rather than the converse.

Shomaker D. Evaluation of an RN-BSN Distance Education Program via Satellite for Nurses in Rural Health Care. Journal of Nursing Education 1997; 36(7): 328-330.
Summary: Telecommunication technology provides a way to expand nursing education and reduce many of the barriers for adults returning to school. Distance education can provide the opportunity to educate more nurses in rural settings where they are more likely to continue to practice and it has the potential to contribute

positively to the quality of rural health care and nurses' satisfaction with their employment. In 1988 the University of New Mexico College of Nursing BSN degree completion program proposed a new paradigm in education for rural nurses, the new paradigm included an interactive television (ITV) satellite delivery system to eight rural sites. This article reports the outcomes of 7 years of satellite delivery of distance education to nurses in rural areas.

Sherwood GD, Armstrong ML, Bond ML. Distance Education Programs: Defining Issues of Assessment, Accessibility, and Accommodation. The Journal of Continuing Education in Nursing 1994; 25(6): 251-257.
Abstract: Identification and resolution of a variety of issues is imperative to establishing effective distance education via telecommunications. In this first-hand experience, the authors described selected issues and possible responses inherent in the development and implementation of a new teaching modality. The decision to pursue distance education by telecommunications should be made only after a thorough examination of the needs, the required resources, and the changes to be expected. Advance planning is essential for problem solving.

Somers S, Homberg J. Interactive distance learning in the health care setting means quality patient care. Michigan Nurse 1996; 69(11): 8-9.
Summary: In this paper the author describes the use of multi-point interactive television to provide educational programs to rural health care providers. This system allows online links with hospitals and educational programs to nurses in rural northern Michigan. The multi-point bride permits participation of the original site with up to 11 receiving sites. REMEC (Rural Emergency Medical Education Consortium) teleconferences are near motion picture quality and participants can ask questions and receive feedback immediately. All programs undergo a comprehensive evaluation to determine the worth of the program and how the interactive component has affected learning. Some of the courses offered are briefly discussed.

Staggers N. Communicating in the 1990s: A Technology Update. Nursing Economics 1990; 8(6): 408-412.
Abstract: New communication technologies are changing the way nurse executives and organizations do business. Today, a dazzling high-tech array of new technologies promise to increase worker productivity and organizational efficiency as well as contain costs. Keeping current with these technologies and choosing among them, however, can be perplexing. This review of communication technologies may help executives and managers understand what technologies are available, their basic mode(s) of operation, potential applications in health care organizations, and how to choose among technologies.

Stephens HJ. Doctor to Doctor via CCTV: Continuing Medical Education in Louisiana. Educational & Industrial Television 1974; 6(7): 11-14.
Summary: In 1973, Division of Continuing Education at Louisiana State University (LSU) School of Medicine launched a monthly two-hour closed-circuit CME television program. The program is produced and is microwaved live to over 20 hospital viewing locations via the statewide Louisiana Hospital Television Network (LHTN). The Network has a two-way talk back system which allows viewers to comment and ask questions on the air. The first section of the broadcasts starts with an interview of the guest speakers followed by the presentation of case studies which illustrate common problems physicians will face with a particular disease entity. An interdisciplinary panel discusses each case and viewers ask questions. The program has averaged about 80 - 100 physicians across all locations.

Straub K. Health care videoconferencing options cover wide range of applications, prices, quality. Health Management Technology 1997; 18(5): 52-56.
Summary: There are as many price-points for health care videoconferencing systems as there are applications and the systems used for these purposes cover a wide range of transmission quality and prices. The quality and price is determined by components such as the type of computer, telephone lines, monitor, cameras, software, microphones and other peripherals. This paper describes the different types and models of videoconferencing technology which can be used (desktop, portable, conference systems), how they function, and technical requirements for operation.

Tangalos EG, McGee R, Bigbee AW. Use of new media for medical education. Journal of Telemedicine and Telecare 1997; 3: 40-47.
Summary: The use of an advanced communication network for education has been an integral part of practice at the Mayo Clinic since 1986. The network has been used for patient care, research coordination and administrative support, as well as for educational programming. In 1994, 2655 hours were broadcast by satellite. There were 42,292 participants, representing a total of 47,364 contact hours. Over half of this activity was educational. In using the satellite system, a number of background support systems have been found to be essential to effective communication. First, highly trained technical staff are required to support the communication system. Second, presenters require formal training in adapting audiovisual materials, such as slides and transparencies, to broadcast media. Third, as use of the system has grown, scheduling and prioritizing among the many users has become an increasingly time-consuming and challenging task.

Telemedicine project brings continuing education to rural doctors. Technological Horizons in Education 1980; 7(6): 35-36.

Summary: In this paper the author discusses the use of a slow-scan television system to provide diagnosis, consultation and continuing education for doctors and nurses in rural areas. Slow-scan TV allows motionless pictures, such as x-rays, EKGs, charts etc., to be transmitted over normal telephone lines. The Sioux Lookout Zone of Ontario is a large region with relatively few health practitioners. A slow-scan system manufactured by Colorado Video Inc. was installed in August 1977 to link 5 areas in the region with its only hospital and with two teaching hospitals in Toronto. The only cost for the system is for long distance phone service. In September 1978, the first weekly education rounds began. This program is very popular with the doctors and has continued for two years. Nurses in the field are also being trained along with a program for patient education.

Television Series for Pharmacists Launched in July. American Pharmacy 1990; 9:16.
Summary: This article describes the development and delivery of "Pharmacy Rounds" which premiered on Lifetime Medical Television in July 1990 and were presented by the University if California - San Francisco School of Pharmacy (UCSF). The program enables qualified pharmacists to receive continuing education credit by taking an exam based on the series which they can obtain by calling a 1-800 number. Each program is funded by a corporate sponsor and topics covered in the series are selected by an advisory board of pharmaceutical experts.

Three Methods for Providing Distance Education: Advantages, Disadvantages and How To's. Nursing Educators MicroWorld 1994; 8(1): 2-3.
Summary: This paper describes several examples of projects involving the use of communications technologies to provide distance learning programs for health care providers. In one example the American Association of Colleges of Nursing has used the PBS Adult Learning Service to market, produce and provide technical support for offering educational programs via satellite to other PBS affiliates, hospitals, and anyone with a satellite dish. In another example the Washington Higher Education Telecommunication System (WHETS) uses a LAN-based two-way interactive video and audio microwave system to provide baccalaureate nursing classes for RN students in four distant locations. A discussion of the technical requirements of the systems and the advantages and disadvantages of the technologies are presented.

Tribulski JA, Frank C. Closed Circuit TV: An Alternate Teaching Strategy. Journal of Nursing Staff Development 1987; Summer: 110-115.
Summary: With the advent of cost containment, nursing education departments must search for the most effective and efficient means of meeting the educational needs of nursing staff. Closed circuit television enables nurses to keep current and to earn hospital-mandated contact hours without leaving their unit. This article discusses the

planning, implementation, and evaluation phases, as well as advantages and disadvantages, of closed circuit television systems.

Umlauf MG. How to Provide Around-the-Clock CPR Certification Without Losing Any Sleep. Journal of Continuing Education in Nursing 1990; 21(6): 248-251.
Abstract: Teaching and reviewing cardiopulmonary resuscitation (CPR) to employees is an important part of the role and responsibilities of hospital nurse educators. The new teaching technologies of computer-assisted instruction and interactive video have been merged into a teaching/learning system that was tested by a rural federal hospital. Over a 2-month period, more than one third of the hospital's staff members were certified in CPR by the standards of the American heart Association with the learning system. Ease of operation, employee enthusiasm, and easy access to the equipment were identified as important factors that contributed to the successful implementation of this innovative CPR training/review program. Additional evaluation of the system confirmed that the system was efficient, cost effective, and time saving.

Weber JR, Lawlor AC. Professional Nursing Series by Videoconferencing. The Journal of Continuing Education in Nursing 1998; 29(4): 161-164.
Abstract: A consortially developed continuing education series for rural nurses was implemented using videoconferencing technology. This article provides an overview of distance education technologies, the history and goals of the demonstration project at Edinboro University, and the coordination activities and instructional issues faced by the faculty. Participants became acquainted with distance education technology as they developed a process for program development, delivery, evaluation, and for awarding continuing education credits. The project was well received by instructors and students and testified to previous findings in the literature that distance education is a viable delivery system in terms of a teaching tool, learner satisfaction, and cost effectiveness.

Whitten P, Ford DJ, Davis N, Speicher R, Collins B. Comparison of Face-to-Face verus Interactive Video Continuing Medical Education Delivery Modalities. The Journal of Continuing Education in the Health Professions 1998; 18: 93-99.
Abstract: The challenge to provide accessible continuing medical education (CME) programs for physicians and other health care providers in rural communities is ongoing. One possible solution to facilitate physician access to CME is through distance instructional media such as interactive video (ITV). A review of the literature revealed that there is a dearth of research investigating the differences in effectiveness between CME programs delivered through ITV and CME delivered in the traditional classroom setting. The purpose of this study was to compare physician perceptions of the effectiveness of CME programs delivered by ITV and CME

programs delivered in the traditional classroom setting. Results from the survey indicate that ITV and traditional face-to-face CME participants did not feel the majority of attributes related to the content, speaker, and program were significantly different between the two delivery modalities. The implications from these findings are also discussed.

Wurzbach ME. Teaching Nursing Ethics on Interactive Television: Fostering Interactivity. Journal of Nursing Education 1993; 32(1): 37-39.
Summary: This paper discusses the development and personal experiences with the BSN completion program at the University of Wisconsin-Oshkosh which was offered via interactive television. One of the primary hurdles of teaching a course on ITV is getting beyond the technology to allow for natural interaction and true engagement. The author offers several suggestions on means for improving the quality of interactive television programming including effective facilitation and instructional techniques and methods, and tips for creating instructional materials for distribution to distance students and instruction.

Yeaworth RC. Consortia Arrangements and Educational Telecommunication. Journal of Professional Nursing 1996; 12(3): 147-153.

Abstract: Revolutionary and rapid changes are required in nursing programs and products to fit with the developing health care system. Many present-day nurses and nursing faculty will require changes in their areas of expertise. Nursing colleagues that have faculty qualified in the areas of greatest need should explore the use of consortia for delivering distance education. In this way, quality can be controlled, and the conflict of interest involved in schools trying to change the preparation of their own faculty can be reduced or resolved. Organizing consortias is complex, with problem areas in administration, personnel, and resources. Selected television satellite networks are offered as examples of how to manage the problem areas as possible vehicles for course delivery.

Young HL. Medical education by satellite: the EuroTransMed experience. Journal of Audiovisual Media in Medicine 1995; 18(2): 75-78.
Summary: This paper reviews the development and implementation of the EuroTransMed project which has been established to provide a pan-European medical education service, delivered free to end-users, providing a continuing educational interactive forum for clinicians. EuroTransMed, set up as an experiment to investigate the use of satellite-delivered continuing medical education, now supplies regular programming to receive sites in 20 European countries. Programmes are broadcast live and are interactive, enabling doctors to have access to experts and opinion leaders and to question and challenge them. This review paper highlights the

development and technical problems which have taken place during the initial establishment of EuroTransMed. The current status and future prospects are identified.

Young HL. Satellite-delivered medical education and training for Central Europe: a TEMPUS project. Journal of Telemedicine and Telecare 1996; 2: 14-19.
Abstract: This paper reports the experience gained in delivering continuing and postgraduate medical education by satellite to update medical teachers in Central Europe. An infrastructure of receiving sites was established in the Czech. Republic,Slovakia, Poland and Hungary. The sites participated in regular, live interactive broadcasts on a range of medical education topics. Over three years a network of sites was established incrementally and a national coordinator identified for each country, who fed back from national coordinating committees to an overall steering body. In the final year a formal evaluation revealed high satisfaction levels and maintenance of activity during the grant period. The major problems related to a lack of telephone lines to facilitate interactivity, the timing of the programmes, and the need for training in medical English language. Video libraries were established, and the majority continued to be active at the end of the project grant. Material was incorporated into both undergraduate and postgraduate education. It is calculated that continuing professional education development can be delivered at less than 18 ECU per participant per country.

Computer-Mediated Learning Technologies Abstracts and Study Summaries

Adsit KI. Multimedia in nursing and patient education. Orthopaedic Nursing 1996; 15(4): 59-63.
Abstract: Multimedia education or computer-based instruction is currently being used in both patient and nursing education for staff development, continuing education, general health information and informed consent. It can be used to teach content, skills and concepts, as well as to simulate situations. Multimedia may be incorporated as a part of other hospital systems to provide individualized patient education by using actual patient data. Multimedia as an instructional strategy has some definite advantages and disadvantages that can affect integration and use. It will be used more and more in the health care environment to provide consistent, accurate information to nurses and patients.

Alusi GH, Tan AC, Campos JC, Linney A, Wright A. Tele-education: the virtual medical laboratory. Journal of Telemedicine and Telecare 1997; 3(Suppl 1): 79-81.
Abstract: The virtual medical laboratory (VML) was conceived to provide an Internet-accessible resource, offering access for clinicians and scientists to an invaluable data archive at the institute of Laryngology and Otology, London. The Institute is home to the largest collection of temporal bone, laryngeal, skull and sinus sections in Europe. The skull and sinus collections include an extensive section consisting of animal material. These were contributions from zoos around the world. Over the last 50 years, samples have been carefully sectioned and stained by specialized technicians to produce histology slices of most regions of the head and neck. The aim of the project is to create a virtual medical laboratory, which will provide access to archived histological material as well as computerized tomography and magnetic resonance data. Central to this aim is the reconstruction of the internal anatomy of the temporal bone from two-dimensional histology slices, to create three-dimensional views that can be used for anatomical simulation and surgical training in otolaryngology. State-of-the-art three-dimensional reconstruction and rendering technology allows us to develop such a model. C omputer-generated simulation could be made available to all hospitals in which otolaryngology is practised, via digital communication networks. We aim to develop core technology in our own specialty that is applicable to other fields of higher education, which have not been exposed to such modern teaching modalities. This has the potential to become an invaluable teaching resource for anatomists, surgeons and other scientists.

Alves T. Using CD-ROM to deliver a series of CME programs. Interactive Healthcare Newsletter 1995; 11(7/8): 9-10.
Summary: This editorial was written to discuss the presentation of a series of Silver Platter educational CD-ROMs. The product line is made up of multimedia educational programs that address specific clinical topics in a didactic format. Results from a study investigating CD-ROM use for CME credit are mentioned. The various features of the CD-ROM enable the users to create educational materials,

design their own multimedia demonstrations, annotate each frame and print handouts in addition to the basic function as a product for gaining CME credit.

Analyzing the cost-effectiveness of CAI. Nursing Educators Microworld 1990; 4(4): 30-1.
Summary: This paper provides some guidelines that can be used to calculate the value of your time and what you produce in terms of dollars and cents, calculate the true cost of staff nurse education when their salaries are included, demonstrate the cost-effectiveness of using CAI and/or IVD and negotiate for hardware and software. There are two major costs in presenting any educational program: the cost of development and the cost of delivery. These costs differ depending on the type of delivery you are proposing. Costs of development in a traditional learning program include the time you spend determining goals and objectives, reading and research, conceptualizing and planning your approach and the time and materials necessary to produce A-V aides and handouts. The costs of delivering the program include preparation activities, the actual delivery and after program activities. Since the costs for development are fixed, obviously the cost per education hour is reduced when the program is repeated and the cost per student is reduced when the total number of students is increased. When offering a CAI program there are different development and delivery costs including those associated with purchasing computers and the CAI program itself. The authors develop an "example" comparison between the costs of running a traditional continuing education program versus a CAI program and show conclusively that CAI is more cost-effective especially for repetitive learning. Even when the full cost of new computers and a CAI program are included, there is still a significant savings over the traditional method.

Anthony DM. The value of computer networks in nursing. Professional Nurse 1997; 12(12): 865-8.
Summary: A number of computerized and networked clinical and administrative systems are currently being used in the NHS. Networks can be confined to a single area or may be part of a wide area network, such as the NHSNet. The most senior nurses in 355 trusts in the UK were given a survey. From the results of the survey, the author concludes that computer networks used by nurses must address clinical needs and be relevant to patient care. The author provides information on various services and limitations involved in computer use. The services discussed include Local and Wide Area Networks (LAN and WAN), information services, electronic journals, e-mail lists, HISS, NHSNet, and the Internet. One limitation of using networks in nursing is the lack of security.

Barker JL, Klutman NE, Scott BE, White SJ. A comparison of computer-assisted instruction and printed information as methods of pharmacy continuing education. Hospital Pharmacy 1987; 22: (1210-1212).
Abstract: A continuing education (CE) program was developed to teach hospital pharmacists parameters for monitoring adult total parenteral nutrition (TPN) patients. The effectiveness of a computer-assisted instruction (CAI) module as a method of CE was compared with that of printed information (PI). The computer program was developed using an Apple IIe personal computer and ApplePilot. Forty-nine hospital pharmacists were given a pretest, the CAI or PI program, a posttest immediately after the instruction and a retention test 2 weeks later. The CAI group (n=23) had mean test scores of 53.3% for the pretest, 87.7% for the posttest and 81.9% for the retention test. The PI group (n=26) had mean test scores of 54.2% for the pretest, 84.7% for the posttest and 78.2% for the retention test. Both methods were effective CE programs based on increases in mean test scores from pretest to posttest. Retention–test scores showed a statistically significant drop from posttest scores for each group. A comparison of mean retention-test scores with mean pretest scores for each group demonstrated that participants in each group had retained a statistically significant amount of material from baseline knowledge. When differences in mean pretest, posttest and retention test scores were compared between the two groups, no statistically significant differences were found. CAI and PI were equally effective methods of continuing education.

Barnes BE. Creating the practice-learning environment: using information technology to support a new model of continuing medical education. Academic Medicine 1998; 73(3): 278-281.
Abstract: Many of the traditional approaches to providing continuing medical education (CME) have failed to improve physician performance and health care outcomes. In the current health care environment, physicians are being held to unprecedented levels of accountability to patients, payers and society at large. A greater emphasis is being placed on measuring and improving the clinical and fiscal outcomes of medical care. If they are to help physicians practice more effectively and efficiently, CME developers must reformulate the missions and goals of their programs. CME must become a means for improving patient outcomes through enhanced physician performance. The author describes how a new practice-learning model for CME might be implemented using currently available information technology. She also discusses how CME programs, with the help of information technology, can help physicians identify learning opportunities, find the best resources for learning and apply learning to practice. She then briefly discusses three programs that have begun to utilize information technology to expand the scope of CME: the Maintenance of Competence Program in Canada, the Stanford Health Information Network for Education and a computer-simulation program at the Indiana University School of Medicine.

Baxter B. Earning CE credits on the net. Nursing '97 1997; 27(6): 20.
Summary: This paper was written to provide a list of several sites that offer CE credits for nurses online. Various Web-sites offer CE credits online where you can read the article and take the test and even get the results right away from providers who offer instant processing and let you charge the fee to your credit card. Before spending any money on these courses a phone call should be made to your board or organization to confirm that the course offerings you are interested in have been accredited and will meet your state board's requirements for relicensure or requirements for re-certification.

Bayne T, Bindler R. Effectiveness of medication calculation enhancement methods with nurses. Journal of Nursing Staff Development 1997; 13(6): 293-301.
Abstract: Medication calculation errors occur in all settings and cause serious disruption in treatment protocols. This experimental study used a pretest-posttest, control group design. Sixty-seven RNs from three healthcare agencies completed all phases of the study. All nurses completed a 20-item medication calculation test, used both as the pretest and the posttest and completed a short questionnaire that contained demographic and attitudinal items. After taking the pretest, nurses were assigned randomly to one of three experimental groups or a control group. Intervention times for the experimental groups totaled 3 hours, followed by a posttest 4 to 5 months after the pretest. Scores on the pretest ranged from 25% to 100% (mean = 75.5%, SD = 15.13) and from 30% to 100% on the posttest (mean = 80%, SD = 14.72). Scores improved for all groups except the self-study workbook group. No significance difference was found between the experimental groups or the control group for posttest medication calculation test scores. The classroom intervention was most costly and the workbook intervention was the least costly. The nurses identified the workbook intervention as the most satisfying method and computer assisted instruction (CAI) as the least satisfying. A strong positive correlation existed between the nurses' self-assessment of comfort and skill levels with medication calculation test scores. Questions necessitating multiple calculations and those necessitating a conversion not provided were the most difficult to answer correctly. Staff development educators need to address their role in improving the effectiveness of medication calculation.

Bergeron BP. Technology-enabled education. Methods to bring the instructor and library to you. Postgraduate Medicine 1998; 103(5): 31-34.
Summary: This paper discusses the applications of multimedia education for physicians. Whereas traditional avenues of CME are self-limiting, technology can efficiently present much more material and when properly executed, it can be entertaining as well as effective. One of the potential advantages of computer-based CME programs is that they can be individualized so content depth, scope and presentation rate match your specific needs. The Web concept of anytime, anywhere

access to information whether you're in the office, at home, or on the road, is highly marketable in medicine and other disciplines. The author's criteria for choosing an educational CD-ROM or Web-based educational experience are the following: quality and quantity of content must be at least equivalent to what is available in printed or lecture form, all content materials must be available on demand, delivery must be engaging and highly interactive using multimedia when appropriate, and the cost must be in line with an equivalent text or conference.

Billings D. Selecting CAI software. Dimensions of Critical Care Nursing 1988; 7(2): 118-125.
Abstract: As instructional software for critical care nursing becomes increasingly available, nurses and nurse educators must be prepared to make knowledgeable decisions about selecting software. The purposes of this article are to advocate a thorough evaluation of Computer Assisted Instruction (CAI) software before purchase and describe a systematic approach to previewing and selecting CAI software for use in critical care settings.

Billings DM. Advantages and disadvantages of computer-assisted instruction. Dimensions of Critical Care Nursing 1986; 5(6): 356-362.
Summary: As microcomputers and networked mainframe computers become increasingly available, nurses in critical care settings must become aware of the advantages and disadvantages of using computer-assisted instruction (CAI) in order to make choices about using this medium of instruction for orientation, staff development, or patient education. Although CAI has been heralded as a panacea for instruction and training, there is, in fact, controversy over the potential and actual merits of the medium. As with any medium of instruction, CAI has advantages and disadvantages and decisions for use must be based on the needs of the learners, the instructors and the administrators.

Billings DM. Issues in teaching and learning at a distance: changing roles and responsibilities of administrators, faculty and students. Computers in Nursing 1997; 15(2): 69-70.
Summary: Distance learning delivery systems can make nursing education accessible, asynchronous, active and affordable. At the same time, these benefits must be balanced by a "systems view" of teaching and learning that supports administrators, faculty and students as their roles and responsibilities change to meet the demands of a restructured educational environment. Nurse educators can continue to build on a growing experience base in distance education while conducting further research to answer questions about "best practices" for teaching and learning at a distance.

Bittorf A, Bauer J, Simon M, Diepgen TL. Web-based training modules in dermatology. M.D.Computing 1997; 14(5): 371-381.
Abstract: With the goal of using the full power of the World Wide Web for computer-based education, we developed an interactive system for training in dermatology with a database of several thousand color images. The system consists of lecture scripts, case reports with recorded sound, an online atlas and a quiz system -- all relying on the underlying image database. The images used have been reviewed and rated by a senior dermatologist. At present, they are described with a hierarchical key system that permits searching for images by their content. We have evaluated our statistics on access and the results of an open user survey based on an adaptive questionnaire. The responses to 200 questionnaires completed in a two-month study period are encouraging. The online resources are being used not only for training in dermatology but also for continuing education and reference.

Bolwell C. Extensive use of CAI for hospital orientation and continuing education. Nursing Educators Microworld 1989; 3(6): 44.
Summary: This editorial was written to discuss the application of computer resources to a Texas hospital continuing education department. This hospital has been incorporating computers into its continuing education and orientation program since 1986. Due to overwhelming support from the hospital administration, the program has grown substantially. Throughout the year learning contracts are made between staff nurses and their unit directors. Each year, each nurse has a paid "Skill Day" in which they update CPR, review codes, fire, safety and infection control and take a medications test. This program results in no down time from each unit (which keeps administrators happy) and hospital educators can spend more time on the unit getting to know staff and finding out what there needs are. This paper demonstrates the benefit of having administration recognize the value of independent learning.

Buchholz LM. Computer-assisted instruction for the self-directed professional learner? The Journal of Continuing Education in Nursing 1979; 10(1): 12-14.
Summary: In this paper the author provides the advantages and disadvantages of computer-assisted instruction and discusses how they apply to professional continuing education. The advantages of CAI for the learner and for education in general are: ability to converse with the course authors on a continual basis; lack of scheduling restraints; the ability to stop and begin again at a later date exactly where you left off; highly individualized instruction that encourages active learning; offers a greater number of options and responses; helps shift the emphasis in education from teaching to learning; the educator becomes a helper, facilitator, consultant, guide, and resource person and not merely a transmitter of knowledge; in many cases teaching ability is improved; the instructor can receive up-to-date reports of student or staff

members progress through the course. Issues of concern include: What effect does CAI have on the learner? What type of person learns best by CAI? How does it influence speed, quality and retention of learning when compared to traditional methods? Previous research carried out on these two topics have concluded that: with a proper introduction, CAI is received enthusiastically by learners; motivation seems to be at a high level; equivalent or superior grasp of CAI presented material in ½ or 1/3 the time required by the conventional classroom method (2-6).

Buisson CJ. Computer applications in nursing continuing education. Nursing Clinics of North America 1985; 20(3): 505-515.
Summary: The evolution of microcomputers and the availability of commercial software programs have put computer capabilities within the reach of all continuing education administrators. The author states the implementation of an automated information system demands: 1) the knowledge of the administrative process, 2) an understanding of computer devices and the software that makes them work, and 3) training skills, particularly those related to change theory. Using this knowledge, the conversion to an electronic information system is a much easier task that it used to be.

Burnham J. Medical information on the Internet. Alabama Medicine 1996; 65(8-10): 9-13.
Abstract: Connecting to the Internet allows health care professionals to access medical information at computer sites worldwide, to search databases, communicate with peers, obtain continuing education, retrieve images and software, obtain drug information and access statistical data. Users can access sites with "virtual patients," search library catalogs, locate jobs and post resumes and explore conference sites and topics. Rural health care professionals can have access to medical information equivalent to their urban peers. Information is usually available over the Internet much more rapidly than through traditional print methods.

Callender-Price N. Continuing education keeps pace. Continuing education takes on technology. NurseWeek 1996; 9(26): 6-7.
Summary: In this paper the author provides a brief look at technology in continuing professional education. The author begins by discussing the application of computers to DE. Nurses will have to learn to use the Internet and World Wide Web because in a few years it will be the primary means of communicating. Videoconferencing is also a popular form of continuing education in nursing, and the authors state that initial studies comparing distance learning with the traditional CE courses show that distance learners perform as well, if not better, than traditional classroom CE learners. The author frequently mentions the opinions of Christine Hudak from the University of Cleveland who emphasizes that adult learning principles are an

important part of any CE course and that the majority of DL in the future will be via the Internet with the addition of multimedia video, audio, and interactive systems.

Caldwell RM. Computer based medical education: new ways to meet persistent needs. Performance and Instruction (NSPI Journal) 1981; 20(10): 11-14.
Summary: This paper describes: (1) the need for alternative delivery systems in CME, (2) the benefits which can be derived from using computers to deliver CME, (3) the ways that instructional delivery can be improved using computer based education, (4) how efficiency and cost effectiveness can be increased using computers and (5) current and future applications of computer technology to CME. The applications of computer technology to all phases of medicine and health care are unlimited. We must, however, continue research into the most advantageous use of these new technologies and begin to train health care professionals in the operation and use of computer systems of all types. The result can only be improved medical and health care in the future.

Carroll P. Writing and evaluating computer-based training programs. Nurse Author and Editor 1997; 7(1): 1-3.
Abstract: Publishers are preparing for the hi-tech future and authors and editors need to also. Publishers know that book sales may be down in the future, while computer program sales are expected to increase. Most book publishers have added media divisions to position themselves for the future. Authors and editors can also shift from writing or editing books to developing computer-based training programs. This author tells you how to write, edit, or evaluate the new computer-based training programs.

Chao J. Continuing medical education software: A comparative review. The Journal of Family Practice 1992; 34(5): 598-604.
Abstract: Personal microcomputers can be used by physicians for continuing medical education (CME). Advantages of computerized CME include local control over the topic, time, place and pace of instruction. Computers can be interactive, providing selected information that depends on the desires and needs of the physician. Learners have different preferred styles of receiving information and computer programs can be written to appeal to a particular style of learning. Three examples of commercial software programs available for CME are reviewed. Cyberlog should appeal to those who like to learn from reading textbooks but also desire simple computer graphics and case simulations to reinforce key concepts. Patient Simulator II is a detailed patient simulation for those who learn best by doing. A subscription to Discotest provides patient management problems and multiple choice questions (no graphics) based on information in Scientific American Medicine. No one program is suitable for all family physicians.

Chen CC, Hoffer PB, Sweet HA. Hypermedia in Radiology: Computer-assisted education. Journal of Digital Imaging 1989; 2(1): 48-55.
Abstract: Hypertext is a new computer-based method of presenting information that provides greater flexibility than conventional methods of continuing education. With a hypertext system, an individual using the computer can acquire more information on a word or concept that needs to be pursued in depth. Hypermedia is an expanded concept, which uses the computer's ability to incorporate images, sounds and video images in addition to text. This interactive, multimedia approach customizes information for more effective learning. The authors devised a prototype hypermedia textbook of nuclear medicine using a personal computer with hypermedia software that contains text, graphs, tables, figures, literature citations and an easily perusable image database. All the information is organized with multiple cross-references, allowing instant branching to relevant facts, in different levels of detail. The system's applications and the ease of expansion or modification by the user are described.

Conners HR. Telecommunications: The Kansas example. Advance for Nurse Practitioners 1998; 6(6): 40-4, 66.
Summary: In this paper the authors discuss the use of telecommunications technology in the education of rural nurses in Kansas. Technologies discussed in this paper include: compressed video and the Internet. Both allow students to remain in their communities and maintain family, work and lifestyle responsibilities while continuing their education. Students enrolled in these courses learn to use the technologies which can be used as a tool to gain telehealth information and services. Many faculty have to learn new skills to teach with these new technologies, and they need support in terms of time, resources and rewards. Students in distance learning courses need to be: highly motivated, disciplined, willing to embrace new technologies and be willing to adapt to a new learning environment. They also need to have a basic set of technology skills and access to appropriate hardware and software. For courses on the Internet, students need to be familiar with the computer, e-mail and other Internet services.

Costaridou L, Panayiotakis G, Sakellaropoulos P, Cavouras D, Dimopoulos J. Distance learning in mammographic digital image processing. The British Journal of Radiology 1998; 71(842): 167-74.
Abstract: The potential of interactive multimedia and Internet technologies is investigated with respect to the implementation of a distance learning system in medical imaging. The system is built according to a client-server architecture, based on the Internet infrastructure, composed of server nodes conceptually modelled as World Wide Web (WWW) sites. Sites are implemented by integration and customization of available components. The system evolves around network-delivered interactive multimedia courses and network-based tutoring, which

constitute its main learning features. This potential has been demonstrated by means of an implemented system, validated with digital image processing content, specifically image enhancement. Image enhancement methods are theoretically described and applied on mammograms. Emphasis is given in the interactive presentation of the effects of algorithm parameters on images. The system end-user access depends on available bandwidth, so high-speed access can be achieved via LAN or local ISDN connections.

Cragg CE. Nurses' experiences of a post-RN course by computer mediated conferencing. Computers in Nursing 1994; 12(5): 221-226.
Abstract: Students who had completed a post-RN university nursing course by computer mediated conferencing participated in a qualitative study examining their experience with this mode of delivery of distance education. All seven students reported that great difficulties with the technology at the beginning of the course caused them extreme frustration. However, despite the lack of user-friendliness of the technology, the students participated actively, functioned as a group, developed strong personal ties and mastered the required content via the computer. These multiple-role women appreciated the ability to participate in discussion without the requirement of being at a specific place at a particular time. Having overcome the initial difficulties with the technology, all the students were enthusiastic about the method and would sign up for another computer mediated course.

Criddle LM. Computer-assisted instruction. A successful approach to mandatory annual review education. Journal of Nursing Staff Development 1995; 11(4): 219-225.
Abstract: Nurse educators have used various teaching strategies to comply with annual infection control and safety review requirements. In this study, the author investigated a computer-assisted instructional program that allows individualized education on the nursing unit during regular work hours. Significant time and cost savings to the institution were realized and user satisfaction and compliance were high.

Cuevas LE, Moody JB, Macfarlane BJ, Rada R, Ghaoui C. The use of hypertext: demonstration of the methods for investigating an epidemic of meningitis. Medical Education 1993; 27: 91-96.
Abstract: The Meningitis Hypertext Case Study is a computer-assisted learning module developed by the Liverpool Epidemiology Programme as part of a comprehensive set of modules and case studies to assist health workers to learn epidemiology. The objectives of the case study are to highlight important concepts in diagnosing an epidemic of meningitis. It has been developed using hypertext software (LINKWAY) which allows interactions with other epidemiological software

(EPI INFO) for the analysis of the data. The case study makes extended use of graphical displays, has a user-friendly presentation and can be used by individuals and groups. Our initial experience indicates that this form of computer-assisted learning has considerable potential by providing users with an organized path through a series of problems set in a realistic environment. This could prove to be potentially useful in developing countries where up-to-date learning materials are often unavailable.

D'Alessandro MP, Ackerman MJ, Sparks SM. Educational Technology Network: A computer conferencing system dedicated to applications of computers in radiology practice, research and education. Journal of Digital Imaging 1993; 6(4): 237-40.
Abstract: Educational Technology Network (ET Net) is a free, easy to use, online computer conferencing system organized and funded by the National Library of Medicine that is accessible via the SprintNet (SprintNet, Reston, VA) and Internet (Merit, Ann Arbor, MI) computer networks. It is dedicated to helping bring together, in a single continuously running electronic forum, developers and users of computer applications in the health sciences, including radiology. ET Net uses the Caucus computer conferencing software (Camber-Roth, Troy, NY) running on a microcomputer. This microcomputer is located in the National Library of Medicine's Lister Hill National Center for Biomedical Communications and is directly connected to the SprintNet and the Internet networks. The advanced computer conferencing software of ET Net allows individuals who are separated in space and time to unite electronically to participate, at any time, in interactive discussions on applications of computers in radiology. A computer conferencing system such as ET Net allows radiologists to maintain contact with colleagues on a regular basis when they are not physically together. Topics of discussion on ET Net encompass all applications of computers in radiological practice, research and education. ET Net has been in successful operation for 3 years and has a promising future aiding radiologists in the exchange of information pertaining to applications of computers in radiology.

D'Alessandro MP, Galvin JR, Erkonen WE, Curry DS, Flanagan JR, D'Alessandro DM, Lacey DL, Wagner JR. The virtual hospital: An IAIMS integrating continuing education into the work flow. M.D. Computing 1996; 13(4): 323-329.
Abstract: Researchers at the University of Iowa are developing an integrated academic information management system (IAIMS) for use on the World Wide Web. The focus is on integrating continuing medical education (CME) into the clinicians' daily work and incorporating consumer health information into patients' life styles. Phase I of the project consists of loosely integrating patients' data, printed library information and digital library information. Phase II consists of more tightly integrating the three types of information and Phase III consists of awarding CME credits for reviewing educational, material at the point of patient care, when it has the most potential for improving outcomes. This IAIMS serves a statewide population. Its design and evolution have been heavily influenced by user-centered evaluation.

Daly JE, Nicholls DK, Brain KR, Grassby PF, Temple DJ. A novel approach to computer-assisted learning for pharmacists. The Pharmaceutical Journal 1990; 245 (October 13 Suppl): E1-E3.
Summary: This paper mentions some of the following advantages of CAL and it also suggests criteria that must be satisfied if the program is to be successful. Advantages

of CAL: 1) the user initiates the learning process and is then required constantly to interact with the computer; 2) the computer is able to respond appropriately to the knowledge demonstrated by the user; 3) the computer can be programmed to allow the user to explore blind alleys and thus prove to themselves that they have selected the wrong path. The criteria for successful CE: 1) the program must be enjoyable and simple to use, because some CE is not mandatory; 2) programs must appear to be relevant and credible to the practicing pharmacist; 3) pharmacists must have appropriate hardware to be able to use the programs.

Davis KA. Development and evaluation of computer-based training for pre/post Human Immunodeficiency Virus test counseling. Journal of Nursing Staff Development 1998; 14(2): 69-72.
Abstract: Computer-based instruction provides flexibility for staff development in the context of downsizing and rapid change in hospitals. There is an increasing need for nurse involvement in human immunodeficiency virus test counseling in hospitals and clinics because the Center for Disease Control has recommended that human immunodeficiency virus testing be offered to all pregnant women. In this article, the author describes the development and evaluation of a computer-based instruction program to train nurses in human immunodeficiency virus test counseling.
Eager W. How to successfully implement medical education via the Internet. Healthcare Information Management 1997; 11(3): 113-123.
Summary: The focus of the following paper is to illustrate why CME training via the Internet is an effective and convenient way for medical professionals to access valuable educational information and receive CME credit and certification. With its inherent ability to make multimedia presentations and enable users to interactively take tests, search databases and communicate, the Internet is perfect for remote education.
Online medical education can provide immediate access to relevant curricula including text and audiovisual materials. There is also online testing with immediate feedback and the possibility for interaction with medical experts and discussion groups.

Evans P, Cowley D. Computers: A threat and a challenge. A software approach. Nursing Times 1985; 5(5): 42-45.
Summary: The authors of this paper discuss the implications associated with finding or producing appropriate software for continuing education. CAI can offer the equivalent to clinical experience by facilitating the practice of decision-making skills in a safe environment. The objectives of computer-managed instruction are increased accuracy, greater access ,and up-to-date information. The authors state that the objectives of CAI are associated with an approach that promotes learner participation and facilitates the development of decision-making and evaluation skills through simulation of clinical experience. The final topic of the paper is a discussion of

resources that are required to write an educational program including expertise, hardware, time and finance.

Farmer J, Richardson A. Information for trained nurses in remote areas: do electronically networked resources provide an answer? Health Libraries Review 1997; 14: 97-103.
Abstract: This paper reports on a research project which examined the potential of the Internet and other networked information resources, to improve access to information for trained nurses working in remote areas. This paper provides a review of current literature in the field. It describes the research carried out, presents a summary of the research findings and discusses the implications of these findings. The paper concludes that the Internet and networked resources do have considerable potential to improve access to information for nurses working in remote and rural areas. However, information skills, along with professional guidance, are also required.

Ferrance Porter S. Application of computer-assisted instruction to continuing education in nursing. The Journal of Continuing Education in Nursing 1978; 9(6): 5-9.
Summary: In this paper, the author discusses the advantages and disadvantages of applying computer-assisted instruction to continuing education in nursing. The author begins the paper by pointing out the relative lack of publications regarding the use of CAI in postgraduate nursing education. Although there is little information published about cost-effectiveness and advantages of the computer, the author sees the computer as a means of organizing and regionalizing continuing education in nursing. Computer-assisted instruction has many advantages including: omission of travel time and expense; convenience; allows the learner to be independent and self-directed; provides a program that is sensitive to learner attitudes, learning needs and level of knowledge; interactive; provides immediate feedback; teacher can determine at any time how the student is progressing; can provide a means of career development and upward mobility; provides an efficient and convenient mode for mandatory continuing education; provides more free time for the teacher allowing him/her to focus on individuals; offers diversity in authorship. The current disadvantages: lack of stable financial support, experienced staff, standardization of hardware and software, incentives to develop programs and time; who will make decisions about the minimum level of competence required; will evaluation results be grounds for dismissal; and other job security questions.

Fiker CR. The Internet and the pediatrician: should there be a connection? Clinical Pediatrics Phila.1996; 35(5): 229-235.
Abstract: The Internet, an extensive network of interlinked computers storing immense quantities of information, is growing exponentially. The author was interested in discovering what sources of information exist on this network that might be of importance to the pediatric health care provider. To accomplish this aim, a literature review was undertaken, relevant articles were studied and the Internet and its own resources were used to seek out information that might be helpful to pediatric practitioners. Many interesting resources of potential importance to the pediatric health care provider were found and are described in this paper. Besides being an important storehouse of documents, images and factual information, the Internet has, in addition, communication facilities such as e-mail and listservs, that make it a particularly useful resource. It seems prudent that all pediatric practitioners should have some form of access to the Internet.

Gallagher K, McFarland MA. The wired physician: Current clinical information on the Internet. Missouri Medicine 1996; 93(7): 334-339.
Abstract: The Internet and associated World Wide Web are electronic technologies that can help physicians identify needed clinical information quickly and can put physicians in ready contact with other specialists for communication and consultation. This article outlines the kinds of resources available on the Internet and methods for connecting your personal computer to the "information superhighway". Selected Internet sites and a short bibliography of books and articles relating to the Internet are included.

Garner R. Telematics: The potential of computer mediated communication in professional practice. Psychiatric Care 1998; 5(2): 72-75.
Abstract: The field of telematics is having an increasing impact on the way individuals organize the way they function in the various aspects of work, rest and play. One aspect of telematics is computer mediated communication (CMC) and this paper explores its use in facilitating autonomous professional practice in healthcare. The concepts of CMC, professionalism and collaboration are initially defined. The potential role, strength and barriers in the use of CMC are discussed in relation to continuing professional development (CPD) and various aspects of professional practice.

Glover SM, Kruse M. Making the most of computer-assisted instruction. Nursing 1995; 25(9): 32N.
Summary: The purpose of this paper is to briefly describe the benefits that CAI has to offer. These benefits include: reduced learning time – research shows that interactive technologies reduce learning time by an average of 50%, you can move

through the program, skipping areas you are familiar with and concentrating on ones you are weak in; increased retention - active learning leads to better retention than passive learning; accessibility; consistent, current content; safety – novices can practice assessment and other clinical skills without jeopardy to the patient; privacy and patience – good CAI doesn't ridicule, scold or judge you; enhanced motivation – with CAL you are challenged to move to higher levels of expertise. There are three basic CAI formats: interactive menu-driven tutorials, clinical simulations and drill and practice.

Goldsmith D. Nursing and the Internet. M.D. Computing 1998; 15(4): 249-251.
Keywords: Nursing, Computers.
Abstract: The technology of the Internet has changed the way health care practitioners access information. For nurses, the Internet offers the opportunity to improve patient education, nursing education and research, clinical practice and professional communication. Online continuing education courses, e-mail access to expert consultation, clinically specific mailing lists and newsgroups, and online access to national databases are all powerful tools in keeping nurses up-to-date. The authors state that the greatest benefit of the Internet for nurses is probably that it offers a forum for collaboration and exchange of ideas with their peers worldwide. Thus there is a need for all nurses to be prepared for this media revolution.

Hannah KJ, Conley-Price P, Fenty D, McKiel E, Soltes D, Hogan T, Weins D. To explore the use of instructional computing for staff development and patient education programs. Methods of Information in Medicine 1989; 28: 261-266.
Abstract: The changing and evolving profession of nursing necessitates extensive staff development activities on the part of nursing management. This ongoing responsibility is essential to maintaining the currency and competence of practicing nurses and facilitating their professional growth. Simultaneously there are economic constraints coinciding with increased consumer demands for patient education. The purpose of this paper is to explore an innovative teaching method, the use of instructional computing for staff development and patient education programs. The theoretical frameworks for this instructional modality are identified and general advantages and disadvantages of instructional computing applications are described. Specific examples of programs from the literature are briefly discussed.

Hardey M. Research, innovation and practice: The role of the World Wide Web. Nursing Standard Online 1996; 11(11): 1-6.
Summary: This article argues that the WWW is a more economic way to disseminate information and that it has a particular "fit" with nursing as a discipline. The author states that nursing and other professions need to recognize that the WWW is more than just a valuable teaching tool, it also has the potential to transform the research

base of practice. Contemporary nursing is holistic in approach and one could equally characterize the Internet as being holistic in scope. The author also notes several opportunities and constraints that nursing and other practice-based professions may have in utilizing the potential of the World Wide Web: lack of access, the majority of practitioners do not have easy access to a computer capable of accessing the Internet; the 'not for us' perception, computers and nursing have had a history of inappropriate systems being imposed on practitioners mostly for management information purposes -- this has led to a cynicism among many nurses that computers are simply 'not worth the trouble'; uncertain status of the new media, academe has not adequately come to terms with the Internet -- with the pressures on nurse academics ever increasing, there is little incentive for them to become involved in the new media; redefining research and practice, computer-mediated communication in general transcends disciplines, professions and localities -- users become empowered in a way that is impossible within the constraints of printed media and this technology will break down the barrier between researcher and practitioner and change the very philosophies which underpin the sciences.

Harless WG, Lucas NC, Cutter JA, Duncan RC, White JM, Brandt EN. Computer-assisted instruction in continuing medical education. Journal of Medical Education 1969; 44: 670-674.
Summary: Certain developments in computer-assisted instruction have made it feasible as a teaching device in continuing medical education efforts. Physician enthusiasm for the technique at a meeting of the ASA prompted a more systematic study of its potential use in a more structured learning environment. Therefore, a CAI tutorial presentation on emergency resuscitative techniques was incorporated into a week-long postgraduate course in clinical anesthesia held by the University of Oklahoma Medical Center. Data showed that the physicians' attitudes toward CAI, educational television and programmed instruction texts were comparable before exposure to CAI. However, after the CAI lesson attitudes toward CAI and educational television, both of which are movement and picture-oriented techniques, were significantly higher than attitudes toward programmed instruction. A follow-up study was conducted three months after the session to determine whether or not there had been a Hawthorne effect and it showed attitudes toward CAI to be significantly more positive than attitudes toward either educational television or programmed instruction. Because of the small number of subjects involved in this experiment, the study should be replicated before any firm conclusions are drawn. However it does appear that these attitudinal relationships could have a directional effect on continuing education programs.

Hayden KA. Internet tools and resources in continuing health education. The Journal of Continuing Education in the Health Professions 1997; 17: 121-127.
Abstract: The Internet offers a wide range of continuing education opportunities to health professionals. Through Internet services such as electronic mail, listservs, newsgroups and the World Wide Web, health professionals can review current tables of contents from journals, search databases and contact experts. Understanding Internet addresses is useful for identifying quality information on the Internet.

Hayes KA, Lehmann CU. The Interactive patient: A multimedia interactive educational tool on the World Wide Web. M.D. Computing 1996; 13(4): 330-334.
Abstract: To develop a physician-friendly continuing medical education tool for use on the World Wide Web and to improve physicians' clinical and history taking skills, developers at Marshall University designed a multimedia interactive patient encounter for a Web server. Any physician with access to the Internet can use this program to take a history, perform a physical examination, order laboratory and radiologic studies and submit a diagnosis and treatment plan. The system evaluates the user's performance electronically and delivers CME credits by mail. The Interactive Patient has been embraced by the medical community, with many institutions providing links to this new tool and hundreds of physicians using it. The enthusiasm of most users demonstrates that combining education with fun enhances the learning experience.

Haynes CC. Nursing and the net. AWHONN Lifelines 1997; 1(4): 28-33.
Abstract: Access to health and nursing information has never been easier or faster. The Internet and its World Wide Web provides up-to-date health care information on a daily basis. The purpose of this paper is to discuss some of the services offered to nurses via the web. The author provides some information of WWW basics and other Internet networks including gopher, Usenet, Telnet and FTP. The applications of the World Wide Web for nursing research, accessing indexes and online continuing education are also mentioned including several useful Web sites for each topic.

Heinrich JJ, Fichandler BC, Cuono CB. The role of computers in continuing medical education. Journal of the American Academy of Physician Assistants 1988; 1: 380-3.
Abstract: Computers offer unrealized opportunities for improving continuing medical education and the delivery of health care. The benefits of a good computer instructional program are: (1) it is available 24 hours/day, (2) it does not tire, (3) the learner uses it at his or her own speed, (4) it gives instant feedback and (5) it is readily available for updates. Three areas of continuing medical education in which computers are useful are self-instruction, patient management problems, and self-assessment of performance. The impact of computer-assisted instruction and self-

assessment will be felt in all areas of continuing medical education. Physician assistants would benefit by augmenting the traditional educational methods of conferences, reading journals and other such activities with computer-assisted exercises.

Hekelman FP, Niles SA, Brennan PF. Gerontologic home care: A prescription for distance continuing education. Computers in Nursing 1994; 12(2): 106-109.
Abstract: Visiting nurses are increasingly challenged by the health care delivery system to provide sophisticated technological care to a growing number of patients in their homes. Much of this care is devoted to the care of the older adult. Few nurses currently in practice have received formal preparation in gerontology; thus a knowledge deficit exists. Recognizing the challenge of teaching visiting nurses to develop individual interests in the scientific and technologic aspects of gerontologic nursing, the Visiting Nurse Association of Cleveland designed and proposed a comprehensive project to teach gerontologic nursing in the American Nurses Association Standards of Gerontologic Nursing Practice (American Nurses Association, 1987) through discovery learning and distance education via computer and other educational interventions. Community health nursing offers a unique approach to linking practice to education and research and provides organizational and educational alternatives to traditional continuing education.

Held TH, Kappelman MM. Continuing health education through computer technology. Health Education Medical Conference (Miami, Fla.) 1976; 1-10.
Abstract: Computer assisted instruction is beginning to have an important role in the rapidly expanding field of continuing education for health science professionals. At the present time, there are 22 medical specialty boards, all of which require or are about to require some form of continuing medical education for re-certification and studies are being conducted throughout the country to determine the feasibility of using computer based education for obtaining continuing education credits in the health sciences. Computerized clinical case simulations, which offer some interesting advantages over traditional forms of continuing education, can be accessed from Massachusetts General Hospital and Ohio State University on a 24-hour basis. The Health Education Network offers courseware to medical, nursing and dental schools, hospitals and health care institutions throughout the U.S. and Canada. The prospects of using computer technology to obtain continuing health education credit are very real and feasible compared to other means--the costs are reasonable, accessibility to computer based education systems is increasing and the quality and quantity of computerized case simulations are rapidly improving. (Author/CMV)

Herther NK. Education over the Web: Distance learning and the information professional. Online 1997; 21(5):63-72.
Summary: In this paper the author discusses the future of continuing education and also provides some suggestions on how to choose whether or not to participate in distance education courses. The author states that online learning is just in time and at your convenience. Courses can be taken in any subject and from any institution you choose worldwide. In the next five years, the author estimates that virtually every institution of higher education in the U.S. will offer at least a portion of their classes over the Internet. The author offers ten top tips for potential learners in deciding whether or not to participate in distance education courses.

Hodson Carlton K. Establishing technological health care resource links with the distant learner. Computers in Nursing 1995; 13(5): 206-211.
Summary: The purpose of this article is to review some of the issues involved in the delivery of technological access to the health care professional and consumer at a distant learning site. The author offers the following recommendations when considering and integrating technological access at a distant site: establish a collaborative institutional approach for planning, implementation and evaluation, which includes community and network-related external agency representation; consider pilot testing to a limited user population until comprehensive institutional protocols and fiscal projections have been established; specify minimum user hardware and software requirements; consider the collection of user pre-network linkage computer hardware/software information survey data; determine network bandwidth needs required for user applications; determine connectivity options for the user and specify institution user help supported option(s); develop training protocols and materials for user and instructional support personnel.

Hodson Carlton K. Redefining continuing education delivery. Computers in Nursing 1997; 15(1): 17-22.
Summary: Just as technology is transforming the delivery of education, the Internet and advanced telecommunication applications are changing the "face" of CE and the connotation of "lifelong learning". As late as the mid-1980s, a discussion of computer applications in nursing CE focused on the "timely" transition to microcomputers as tools for the enhancement of managerial tasks for increased productivity. Even as recently as 1990, there seemed to be "time" for those providers who were "slower to adopt innovation" to "catch up". Now, the CE provider who does not integrate the microcomputer and advanced telecommunications as an integral component of their delivery modalities may be outsourced rapidly by an educational or commercial competitive unit that is able to utilize the communication medium. As with the "re-engineering" of nursing education, the "re-engineered" delivery modalities of evolving CE entities might now best be conceptualized on a continuum from the traditional mode of time and place dependent to a mode of

synchronous and asynchronous data and advanced telecommunication. Delivery methods will need to be selected according to the target populations, content and situation. The health-care educational provider may discover, as in other industries, that a combination of distance and residential offerings will be the most successful medium for the delivery of CE to the progressively more "information and technologically savvy" lifelong learner of the 21st century. In addressing the dramatic effects of the information technology era on the refocused multimedia/interactive delivery method for student education, educators amply quoted Bob Dylan's phrase of the 1960s, "The times, they are a-changing". And so, we see that the times are also changing at an astronomical rate for the health-care educational provider as well as the individual health-care worker consumer. A number of national and world-wide trends are propelling rapid changes in the delivery modalities and types of emerging providers for health-care CE. Examples of these advanced telecommunications applications of CE opportunities for health-care personnel are becoming more prevalent in the literature and the pattern of CE marketing and delivery evolution can be seen readily on the Internet. Continued program success and viability will belong to the individuals and organizations who are able to conceptualize and envision the positive transformations and opportunities that can occur from the evolving paradigm of education for the lifelong learner of the 21st century.

Hodson-Carlton K, Ryan ME, Siktberg LL. Designing courses for the Internet. A conceptual approach. Nurse Educator 1998; 23(3): 45-50.
Abstract: One current higher education paradigm shift is the movement from traditional classroom settings and interactive television satellite transmission to course and program delivery via the World Wide Web (WWW). The authors describe the experiences of faculty in reconceptualizing and redesigning course and program delivery via the Internet. An electronic "template" has been collaboratively developed by multidisciplinary university partners to facilitate this work. The template incorporates an advanced nursing practice conceptual framework based on American Association of Colleges of Nursing (AACN) core educational essentials for advanced practice combined with a continuum of electronic course tools. Strategies, tools and applications are discussed.

Hoffer EP. Computers for the continuing education of practicing physicians. The Journal of Medical Practice Management 1989; 5(2): 113-119.
Abstract: Computer-based medical education became practical with the wide spread availability of personal computers and the ease of dialing into a central computer via standard telephone lines with a modem. Continuing education credits can now be earned from the privacy and convenience of the physician's home or office via the computer. A variety of courses are available form national medical organizations, medical schools and medical publishers. While examples can give a flavor of the

type of courseware available, only hands on use can help you decide if this style of education fits yours.

Horn KD, Sholehvar D, Nine J, Gilbertson J, Hatton C, Richert C, Becich MJ. Continuing medical education on the World Wide Web (WWW). Archives of Pathology and Laboratory Medicine 1997; 121(6): 641-5.
Abstract: Objective: To present interactive online continuing medical education (CME) over the World Wide Web as a more efficient alternative to traditional modes of CME delivery. Design: A departmental Web site available to those with access to the Internet. Setting: A tertiary-care teaching hospital in the United States. Results: Comprehensive case studies have been developed and are complete with images, text and questions, including explanations for correct and incorrect responses. The images are linked to pertinent text to maximize their educational value. These cases are easily accessible, user friendly and fully referenced. The system became operational in January 1996 and the first CME certificate was awarded to a participant shortly thereafter. Conclusions: Continuing medical education over the World Wide Web is an efficient means of delivering CME to the community at large; it allows participating physicians the latitude to obtain convenient CME credit at their leisure, in contrast to the regimented experience of formal CME conferences or symposiums. The interactive format of the CME cases allows the participant to submit immediate comments or criticism to case authors and receive instant feedback on their own performance, features unavailable in comparable educational software packages. The dynamic environment of the World Wide Web lends itself to the production and dissemination of such flexible forms of CME for the physician and will continue to expand in this capacity into the foreseeable future.

Howard EP. Use of a computer simulation for the continuing education of registered nurses. Computers in Nursing 1987; 5(6): 208-213.
Abstract: The major purpose of this study was to investigate the cognitive and affective gains from the use of computerized cardiopulmonary arrest simulation. A convenience sample of 97 registered nurses completed assessment tools to measure knowledge about a cardiopulmonary arrest situation and their feelings of confidence regarding their ability to assume nursing roles during an arrest. These data were gathered before and after nurses went through the simulation individually. The post-treatment assessment tool also contained an adjective rating scale that measured the nurses' attitudes toward the simulation in five areas: practical value, emotional appeal, dullness, interest value and difficulty. The results supported the hypothesis that the nurses' attitudes toward the simulation were favorable. The cardiopulmonary arrest simulation contributed to nurses' knowledge, as evidenced by differences between the pretest and posttest scores. The simulation also appeared to increase the nurses' feelings of confidence.

Hulsman RL, Ros WJG, Janssen M, Winnubst JAM. INTERACT-CANCER. The development and evaluation of a computer-assisted course on communication skills for medical specialists in oncology. Patient and Education Counseling 1997; 30: 129-141.
Abstract: One of the main problems in training medical specialists in communication skills is the fact that very few specialists participate in such courses. Most courses on communication skills are hard to combine with a busy medical practice because of the course attendance requirement on working days. Interact-Cancer has been developed to facilitate training in communication skills for medical specialists. It is an interactive, computer-assisted course, which fits relatively easily into the busy schedule of medical specialists in oncology because of its flexible character. The course can be followed individually by the participant in his/her own department at suitable periods of time. Interact-cancer has introduced a new training method. In this study, the appeal of the method to the target group has been tested. Thirty-three medical specialists participated in Interact-Cancer. They evaluated the course as worthwhile, relevant to daily oncological practice, attractive and pleasant. They stated that the course brought inadequacies in their own behavior to their attention and encouraged them to change their communicative behavior.

Huntley AC. Dermatology and the Internet. M.D. Computing 1998; 15(4): 246-248.
Summary: This paper discusses the dermatology resources presently available on the World Wide Web. Dermatology is especially suited for the new forms of communication available on the Internet and the WWW. The ability to share clinical images easily and inexpensively is alluring for this visual specialty. There are four main categories of dermatology resources found on the web. They are those offering consultation, reference material, education and public service. E-mail lists appear to serve best as a means of consultation. There are several e-mail groups for dermatologists. The Internet is an excellent location for medical reference material. Information can be universally available, easily updated and quickly obtained. Internet-based education material for dermatologists can be found in discussion lists, electronic textbooks and online journals. The idea of gaining CME credit for participation in an Internet dermatology list is currently under review. Public service appears to be the area in which the dermatology material on the Web is having the greatest impact. Principle sites display existing patient information pamphlets in a digital format. It is likely that these resources will continue to grow and that they will provide stiff competition for the currently predominant paper-based and commercial products.

Hutchinson D. The Internet for healthcare professionals. ORL Head and Neck Nursing 1997; 15(3): 9-14.
Abstract: The Internet is a useful clinical tool for information and communication. Resources that are available on the Internet include the Medline index, full-text

articles, patient handouts, discussion lists, continuing education, medical and pharmaceutical texts and case studies. This article summarizes the different types of resources available and teaches the basic skills for using the Internet to find medical information. Otolaryngology sites are listed and described.

Issues in clinical trials management: Network navigation for the clinical research practitioner. Research Nurse 1997; 3(1): 11-7, 20-2.
Summary: This paper was written to provide a brief history of the Internet along with some of the services it offers. The authors provide definitions and information on IP/TCP, World Wide Web, Servers, Browsers, Search Engines, E-Mail, Listserv, Usenet, File Transfer Protocol (FTP), Telnet, Gopher and Inter Relay Chat (IRC). The key to successful use of the Internet depends on how adept you are at finding the information you want from all of the information that is available. Information on the above services is helpful in locating relevant information on the Internet.

Izenberg N. A virtual minifellowship for primary care practitioners treating patients with HIV/AIDS. M.D. Computing 1998; 15(4): 256-9.
Summary: In this paper the author describes the application of a CD-ROM virtual minifellowship continuing education program for the treatment of patients with HIV/AIDS. Primary care physicians, rather than infectious disease specialists, now provide a substantial portion of routine healthcare for patients with HIV/AIDS, thus physicians need to be more experienced in the fine points of treating patients with this disease. This CD-ROM program offers: quality instructional design, a large quantity of information, high multimedia production values, ease of use and even emotional impact all at a very reasonable cost to the physician. This paper discusses some aspects of the program including a general description, hardware requirements and advantages and minor problems.

Jack Scott C. Applied adult learning theory: broadening traditional CME programs with self-guided, computer-assisted learning. The Journal of Continuing Education in the Health Professions 1994; 14(2): 91-9.
Abstract: We studied relationships among key elements of selected theoretical models of adult learning applied to CME, using a descriptive survey technique and nonparametric statistical analysis. Questionnaires were administered on-site and three months after the course to 346 physicians who attended a seven-day National Emergency medicine CME program in October 1991; response rates were 91 percent and 49 percent respectively. The CME program's content was based on the core content curriculum developed by the Society of Academic Emergency Medicine (SAEM), the American Board of Emergency Medicine (ABEM) and the American College of Emergency Physicians (ACEP). Course faculty members assisted attendees in self-selection of learning projects and instructional resources to meet

their specific self-defined learning styles and needs. We measured program impact at three levels: (1) perception (program quality and effectiveness), (2) competency (the ABEM cores of those who took the written boards) and (3) change in physician behavior (self-reports on incorporation of content into their practices). We also assessed the effectiveness of various instructional methods. The overall quality rating was 4.78 (scale 5=high, 1=low) and the overall effectiveness rating was 3.50 (scale 4=high, 1=low). Recent data support a moderate level of validity in predicting performance/competency in practice from performance on written multiple choice questions (MCQ's). Of attendees who were non-residency trained and reported written ABEM scores, 80% attained the passing level- considered "passing"- of 75%. At three months follow-up, 46% of respondents stated they had incorporated knowledge skills obtained from the program into their practices. An incidental finding was a statistically significant greater use of computers by those who had been graduated from medical schools after 1980 (p=0.026). Physicians as adult learners are self-directed/experientially oriented; influenced by their physical age/state of life; and must "see and feel" their learning needs. These results suggest that this program is effective in helping physicians because of the application of adult learning principles. Specifically, the addition of a nontraditional CME portion onto a traditional program found considerable favor with the participants.

Jewett BS, Holsinger FC, Kuppersmith RB, Buenting JE. Computer-based physician education. Otolaryngologic Clinics of North America 1998; 31(2): 301-307.
Summary: Physicians are turning to computers with increasing frequency to access patients' records and laboratory values, to communicate with colleagues and to keep current with the developments in their field. This article reviews the impact of the computers on the education of medical students and on continuing education for residents and practicing physicians. Furthermore, it emphasizes the importance and need for educating physicians about computers and the basic principles behind their development.

Jim LK, F[illegible]ibeck DJ, Gee JP, O'Bey KA, Fox JL. Evaluation of computer-assisted self-instructional module for pharmacy continuing education. Hospital Pharmacy 1982; 17: 551-557.
Abstract: A computer-assisted self-instructional module was developed as a method of providing continuing education to pharmacists. A prospective, nonrandomized study was conducted to investigate the effectiveness of computer-assisted instruction (CAI). Using an AppleII microcomputer and anticoagulant therapy as the content base, a series of ten case studies was written and programmed. Twenty-two pharmacists from a university hospital and a community hospital participated. Participants were first given a pretest, proceeded through CAI, took the same test as a posttest, then two weeks later, took a different posttest to measure knowledge

retention. The mean test scores before and immediately after the CAI were 55.8% and 80.4%. The mean test score for the two-week posttest was 74%. The mean difference was found to be highly significant for both the pretest and immediate posttest (P<.001) and the pretest and two-week posttest (P<.001). The study suggested that the use of a CAI module was effective in improving, as well as maintaining, pharmacists' knowledge and that a significant portion of knowledge gained was retained after a period of two weeks. Pharmacists' evaluations of this method of continuing education were generally favorable.

Jim LK, Gee JP, Hyneck ML, Shannon MC, Fox JL, Filibeck DJ. A computer-assisted instructional approach to teaching applied therapeutics. American Journal of Pharmaceutical Education 1984; 48: 20-25.
Abstract: A study was conducted to determine the effectiveness of computer-assisted instruction (CAI), as compared to that of a traditional conference format, to conduct pharmacy therapeutics case analysis exercises. Students enrolled in a pharmacy therapeutics course were arbitrarily divided into experimental groups where case analysis exercises were performed by interactive computerized programs and the controlled group where case analysis exercises were conducted in the traditional conference format. Pre- and posttest scores were compared statistically within and between groups respectively to determine knowledge gained and comparative effectiveness of teaching. The results show an equally significant gain in knowledge in the students under both teaching methods, but no superiority was established for either method. Survey of the experimental group showed considerable enthusiasm in expansion of the CAI program to include other therapeutic topics. An examination of various factors in considering CAI as an alternative mode of teaching suggests cost of development, implementation and maintenance of the CAI program to be the most important hindrance. It was suggested that, due to cost considerations, a CAI program should be developed both as a pharmaceutical education aid and as a revenue generating continuing education program.

Karlsson D, Ekdahl C, Wigertz O, Forsum U. A qualitative study of clinicians ways of using a decision-support system. AMIA Annual Fall Symposium 1997; 268-72.
Abstract: We have studied how clinicians approached a decision-support system to manage patient cases. The design of the system under study was based on an integration of hypertext and rule-based systems. World-Wide Web technology was used for the implementation of the system. By using grounded theory and stimulated recall, we found that getting patient-specific support and continuing medical education were the two major usages of the system and that the three parameters of relevance, validity and work were important in describing how the system was experienced by the users.

Keckan M. Computer-based staff training: Can you afford not to? Nursing Homes 1997; 46(6): 101-2.

Summary: This paper discusses the advantages of computer-based training along with some things that should be considered when purchasing a computer-based training program. The advantages include: people can learn individually at their own speed; because the computer is available around the clock there will be fewer staffers off the floor at one time; the message is the same every time; active learning is retained longer than passive learning; learning is virtually guaranteed (learners cannot move on until questions are answered correctly); the necessary administrative documentation is already done for you; a picture is truly worth a thousand words; and training is available 24 hours a day, 7 days a week. The features to look for in a CBT package include: Is the company taking responsibility for the whole package i.e. hardware and software, so that no incompatibility problems will arise. What's been the longevity of the company selling the product? Are they reliable? Are updates part of the package? Customer service attitude: Will they return your calls quickly? Accuracy and appropriateness of content Is the computer format user-friendly for non-computer literate personnel? Are the visuals well done, clear, explanatory, relevant and fast? If viewers have to leave the program can they reenter where they left off? Are governing body regulations covered in the material offered? Do they offer volume discounts? Can staff with more than one educational level learn from this material?

Keisch M, Fox S, Grigsby P, Perez CA. Design and implementation of a microcomputer-based tutorial in radiation oncology. International Journal of Radiation Oncology, Biology and Physics 1992; 23(4): 869-872.

Abstract: The design and implementation of a computer-based training system for radiation oncology was undertaken. A frame-based system was chosen, with factual information from Principles and Practices of Radiation Oncology, by Perez and Brady, as the body of knowledge. Each unit of the system was based on a site (chapter) and consists of three sections: text, review questions and patient management problems. The text section contains text, tables and references and defines the information upon which the review questions and clinical cases are based. The review questions are multiple choice and true-false and immediate feedback is given for both correct and incorrect responses. The patient management problems are interactive and provide alternative methods of presenting information and stimulating problem-oriented thought. The emphasis in all sections is on learning rather than testing. Advantages of a computer-based tutorial include the ability to present large volumes of information easily, the capacity for immediate feedback and the flexibility of format in presentation of material. Potential applications are discussed.

Kilmon CA. Computerized approaches to teaching nurse practitioner students. Pediatric Nursing 1996; 22(1): 16-18.

Abstract: Personal computers in clinical and educational environments have proliferated and offer users new opportunities for individualized learning. Computerized patient management problems are an innovative resource for the teaching of clinical content and problem-solving skills. This article describes two computerized applications and highlights one such personal computer program, NP Clinic, which was designed for use with pediatric and family nurse practitioner students. NP Clinic software is also suitable for providing continuing education to nurses in primary care settings. A discussion of the advantages and disadvantages of computer-assisted instruction is included along with ideas for effective implementation of this learning strategy.

Kizakevich PN, McCartney ML, Nissman DB, Starko K, Smith NT. Virtual Medical Trainer: Patient assessment and trauma care simulator. Studies in Health Technology and Informatics 1998; 50: 309-15.
Abstract: The Virtual Medical Trainer (VMET) combines multimedia sound and graphics with physiological engines, medical-procedures databases and 3-D patients to produce an interactive environment that can mimic the cognitive pre-hospital assessment and care demands of a real emergency. VMET uses a reconfigurable component software and training framework that allows a uniform user interface, ease of increasing training complexity, and expansion of the software components. VMET provides an opportunity to experience a range of trauma scenarios prior to the challenge of an actual trauma situation.

Klatt EC, Dennis SE. Web-based pathology education. Archives of Pathology and Laboratory Medicine 1998; 122: 475-479.
Abstract: Objective: To develop and present computer-aided instructional resources via the Internet, Intranets and desktop computers to augment pathology education. Design: World Wide Web sites available via Internet access and a CD-ROM for Intranets. Setting: The University of Utah School of Medicine, Salt Lake City. Results: A comprehensive set of gross and microscopic images with text, along with interactive examination questions, has been developed and placed on World Wide Web servers. A CD-ROM has been developed for use with Intranets and individual desktop computers. Conclusions: Web-based delivery of computer-aided instruction is an efficient means of enhancing courses for students studying pathology. Both Internet and CD-ROM delivery of educational resources provide flexible access to study materials. Teaching faculty can easily generate and edit web-based materials for efficient resource management. Student performance has been enhanced.

Koch B, Rankin J. Educational computing. Nursing Times 1985; 5(5): 45-48.
Summary: In this paper the authors discuss four articles dating from the late sixties to the early eighties, which deal with CAL in nursing and medical education. Perhaps

the greatest advantage of CAL is that by using a computer to represent patients, the student nurse can practice decision-making skills in a controlled environment. The research (4 papers) discussed in this editorial deal with various CAL packages developed in medicine to perform as simulations or as drill and practice programs. The research findings indicate that CAL programs provide increased flexibility, promoted the development and reinforcement of critical decision-making capabilities, allowed the learner to test their own hypothesis without possible harm to patients, and that interactivity in CAL programs increases learner retention and decreases learning time. The authors conclude by reiterating that evaluation of CAI programs is required in order to allow refinement, modification and future development. The authors also feel that on the basis of the research findings in the cited papers, the full potential of CAL may be realized in patient simulation.

Kripalani S, Cooper HP, Weinberg AD, Laufman L. Computer-assisted self-directed learning: the future of continuing medical education. The Journal of Continuing Education in the Health Professions 1997; 17: 114-120.
Abstract: The purpose of this study was to determine physicians' prior experience with computers, access to computers, and online resources and interest in computer-assisted continuing medical education (CACME). A survey was conducted among a random sample of primary care physicians in early 1995, with 102 respondents. Most physicians (78.4%) reported prior computer use and 37.3% have used computers for self-study. Most respondents (76.5%) also have access to a personal computer, many with a modem (44.1%), CD-ROM (41.2%), or online service (36.3%). Approximately half of physicians (48.5%) indicated that they would be interested in CACME if they could use a computer to which they already have access. An additional 31.3% would be willing to invest in a computer or computer upgrade. Physicians demonstrated greater interest in CACME if they had prior experience with computers, access to a personal computer or online service, or had previously received credit for CACME. The results indicate that most physicians are currently interested in computer-based CME. With the continued growth of CD-ROM, Internet and World Wide Web (WWW) technology, CME providers have an opportunity to reach a large percentage of physicians, particularly those in rural areas.

Laberge PY, Marton P, Racicot JG. Interactive multimedia computer program on ectopic pregnancy and first trimester bleeding. The Journal of Continuing Education in the Health Professions 1997; 17: 187-191.
Abstract: The objective of this study was to introduce a self-learning interactive multimedia computer program in our department of gynecology as a new means of clinical teaching, particularly where video-laparoscopy is used. There are two additional purposes to this module: one is to help students integrate theory with clinical relevance; the other is for active clinicians to upgrade their knowledge and judgment about first trimester bleeding and ectopic pregnancy. A review of all recent

literature through Medline and of some recent textbooks was used to provide content, as well as personal video snippets of laparoscopy and ultrasonography. Pedagogic set-up of the program includes an interactive evaluation of the learner's performance with a total score posted at the end; in the case of student evaluation, there is a secret "back door" that enables the teacher to subsequently see and print for how long and where students navigated. Since November 1994, over 75 4th-year medical students and 18 residents in obstetrics-gynecology have completed the program. All appreciated this new teaching modality and it is now being evaluated by the Society of Obstetricians and Gynecologists of Canada as their first computerized clinical update for all specialists across Canada. Interactive multimedia computer programs such as this are an important step in the maintenance of updated pedagogic tools in a clinical setting.

LancasterD, Willis MA. Computer-assisted instruction (CAI): A time saving, individualized teaching methodology. American Journal of Infection Control 1994; 22(3): 179-81.
Summary: The purpose of this paper is to discuss some of the advantages and disadvantages of using CAI as a method of continuing education. There are several advantages mentioned by the author including: CAI delivers individualized instruction, each learner can progress at his or her own pace and concentrate on areas of greatest interest; CAI delivers high quality instruction, they are developed by experts; CAI saves time for both the instructor and the learner; CAI provides consistent and replicable instruction to all learners; CAI provides a "safe environment" for learners to use critical thinking skills in decision making; Learners using CAI must constantly interact with the program by answering questions and following directions; CAI gives instantaneous feedback to learners' responses to questions, this provides ongoing positive reinforcement for learning efforts; CAI is always ready to provide instruction and can be made easily accessible to learners at any time; CAI is a cost-effective method of providing instruction. Costs decrease in proportion to the number of learners using the CAI program, whereas costs for classroom instruction increase in proportion to the number of learners.

Landis BJ, Wainwright M. Computer Conferencing: Communication for distance learners. Nurse Educator 1996; 21(2): 9-14.
Summary: In this paper the authors describe a pilot-test designed to evaluate the use of computer conferencing as a means of distance education. Both on-campus and distance learning nurses enrolled in the University of Texas Nurse Practitioner (NP) Outreach Program participated in a survey study. The survey was designed to measure learner perception and satisfaction with computer conferencing as a medium for continuing education. Based on results of the survey, the authors conclude that computer conferencing is a useful communication tool in their NP Outreach Program. The technology significantly increased communication between faculty members and

off-campus students. Outreach students are comfortable using computer conferencing and are more competent in learning new technological applications. They also perceived less need for physical interaction with their classmates and were more satisfied with faculty interaction than their on-campus counterparts.

LaRocque M. Online medicine: World Wide Web changes the way physicians and patients interact. WMJ 1998; 97(1): 31-2.
Summary: The purpose of this paper is to discuss how the use of the World Wide Web is changing the way physicians interact with their patients and also how they themselves are keeping up-to-date. Physicians are able to keep in touch with their patients via e-mail. They can also access virtually any research information and post e-mail questions or carry on real-time discussions with physician colleagues. It is important however, to understand that anyone with a computer and a modem can put information on the Web, therefore it is important to be examine the source of the information to assure it's validity.

Lawson KA, Shepherd MD, Gardner VR. Using a computer-simulation program and a traditional approach to teach pharmacy financial management. American Journal of Pharmaceutical Education 1991; 55: 226-235.
Abstract: A study comparing computer-assisted instruction (CAI) and traditional methods during a 1.5 day continuing education seminar on pharmacy financial management was conducted among 50 community pharmacists who were randomly assigned to each teaching method. Analysis of pretests and post-tests showed significant gains in achievement for both groups with no between-group differences. Analysis of follow-up tests indicated that retention of material was not significantly different between groups. Attitudes towards the instructional method were slightly more favorable for the traditional instruction group than the CAI group. There were no significant differences between groups on the pretest or follow-up measures in the number of hours per month spent analyzing financial statements. It was concluded that both approaches are effective for teaching pharmacy financial management in a CE seminar.

Lee W, Ault H, Kirk JS, Comstock CH. Interactive multimedia for prenatal ultrasound training. Obstetrics and Gynecology 1995; 85(1): 135-140.
Abstract: This demonstration project examines the utility of interactive multimedia for prenatal ultrasound training. A laser-disc library was linked to a three-dimensional (3-D) heart model and other computer-based training materials through interactive multimedia. A testing module presented ultrasound anomalies and related questions to house-staff physicians through the image library. Users were asked to evaluate these training materials on the basis of perceived instructional value, question content, subjects covered, graphics interface and ease of use; users were also

asked for their comments. House-staff physicians indicated that they consider interactive multimedia to be a helpful adjunct to their core fetal imaging rotation. During a 9-month period, 16 house-staff physicians correctly diagnosed 78 +/- 4% of unknown cases presented through the testing module. The 3-D heart model was also perceived to be a useful teaching aid for spatial orientation skills. Our findings suggest that interactive multimedia and volume visualization models can be used to supplement traditional prenatal ultrasound training. The system provides a broad exposure to ultrasound anomalies, increases opportunities for postnatal correlation, emphasizes motion video for ultrasound training, encourages development of independent diagnostic ability and helps physicians understand anatomic orientation. We hypothesize that interactive multimedia-based tutorials provide a better overall training experience for house-staff physicians. However, these supplementary methods will require formal evaluation of effectiveness to better understand their potential educational impact.

Leow CK. Internet and surgery. Australian and New Zealand Journal of Surgery 1996; 66: 655-658.
Abstract: In medicine, the Internet is already playing a significant role in the delivery of information on medical conditions, medical and academic institutions and non-profit-making support groups for patients. This article explores some of the available information on the Internet relevant to surgery and discusses its role in surgical training.

Leveridge LL. The interactive videodisc. MOBIUS 1983; 3(2): 68-72.
Abstract: Dynamic audiovisual presentations that are interactive due to the use of videodisc systems provide more efficient and effective communication of those elements of medicine best learned by seeing them, than is possible via traditional modes. This is particularly true when externally interfaced electronic data processors are used to automate the process. While magnetic and stylus-type videodisc players can serve in education, it is the optical videodisc that has the greatest educational potential. The AMA has been exploring the capabilities of optical videodisc systems and demonstrating pilot programs that use good principles of audiovisual and computer-assisted instruction in tutorial formats or presented as patient management problems.

Lugo-Vicente HL. Role of Internet in medicine. Boletin-Asociacion Medica De Puerto Rico 1997; 89(4-6): 82-7.
Abstract: The Internet, the largest network of connected computers, is becoming the ultimate frontier to access information for health providers. This review focuses on how developments of this communication technology have become a useful educational resource in medicine and describes modest ideas in computer network

use. Internet basic resources are electronic mailing (E-mail), discussion groups, file transfer and browsing the World Wide Web (WWW). E-mail brings physicians with common interest together. Surgeons employ it as a communicating tool. Legal and social responsibility is bounded with its use. Discussion groups permits debate including clinical cases, operations, techniques research, career opportunities and meetings. File transfer provides the opportunity of retrieving archives from public libraries. The WWW is the most resourceful tool due to its friendly interface and ease of navigation. The average physician needs to know almost nothing on how computers work or where they came from to navigate through this pandemonium of information. Click and play with today graphical applications encourage the computer illiterate to connect. Establishing the connections envelops the need of hardware, software and a service provider. Future development consists of online journals with new ideas in peer-review and authentication, telemedicine progression, international chatting and centralization of cyber space information into database or keyword search engines.

Lyons J, Miller M, Milton J. Learning with technology: Use of case-based physical and computer simulations in professional education. Contemporary Nurse 1998; 7: 35-9.

Abstract: This presentation will clarify contemporary ideas on the role of technology in education and how it can be employed to improve student learning experiences and outcomes. The paper will emphasise RMIT's role in providing quality education that is relevant to today's world and professional practice. It will examine a specific collaborative (RMIT & ACU), interdisciplinary project 'Pregnancy Simulator: Developing and Enhancing Student Learning of Assessment Skills'. This project consists of a physical pregnancy model connected to a multi-media computer-assisted learning package for the purpose of enhancing student learning of abdominal assessment skills. Our paper outlines an innovative technology-based teaching project and includes current educational issues or problems encountered in professional education, steps already taken to address these difficulties and how this project intends to facilitate learning. It identifies expected learning outcomes for midwives, nurses and medical students and examines pedagogical principles applied to technological applications designed to provide guided discovery for allowing students to build confidence and competence in professional education. The case-based physical and computer simulations contextualise learning to assist transfer of learning to real world situations. This paper will also discuss how technology-based projects can be evaluated and integrated into university curricula to enhance student learning.

Macfarlane SB, Cuevas LE, Moody JB, Russell WB, Schlecht BJ. Epidemiology training for primary health care: the use of computer-assisted distance learning. Journal of The Royal Society of Health 1996; 116(5): 317-321.

Abstract: The Liverpool Epidemiology Programme, based in the Liverpool School of Tropical Medicine, has designed a series of computer-based modules for use in distance learning. The purpose of this paper is to highlight the role of computers in training health workers in epidemiology in developing countries. The aim of the modules is to provide health workers with solutions to problems which they face in their everyday work. The modules are written in hypertext software for IBM compatible machines and interact with the epidemiological software Epi Info. Four modules are described: LEP-Nut which deals with nutritional surveillance, LEP-Ref which looks at the role of epidemiology within a refugee health care programme, LEP-Surv dealing with health surveillance and LEP-Rap which introduces the concept of rapid appraisal. They are also easily distributed, particularly with the development of the Internet. The modules are carefully evaluated before and after distribution. Issues related to their evaluation and subsequent revision are discussed, in particular is the content important, adequate, communicated and useful? A major advantage of computer-based learning materials is that they can be easily updated with new advancements of knowledge and experience from the field.

MacKinnon GE, Pitterle ME, Boh LE, DeMuth JE. Computer-based patient simulations: Hospital pharmacists' performance and opinions. American Journal of Hospital Pharmacy 1992; 49: 2740-5.
Abstract: The performance of pharmacists in using an interactive computer-based patient simulation program and their attitudes towards the simulations are reported. The Institutional patient Medication Simulation (IPMS) program is designed to enhance and evaluate the medication problem-solving skills of pharmacists. Each simulation consists of patient data-gathering, case question and therapy decision modules with initial assessment and monitoring nodes. Five simulations were tested: gout, urinary-tract infection, congestive heart failure, antimicrobial prophylaxis in surgery and hypertension. Pharmacists from nine hospitals were recruited for the study. Participants were asked to perform the simulations within a specified period and to complete attitudinal questionnaires. Of the 91 pharmacists who volunteered, 72 (79%) completed the simulations and the questionnaires. The practitioners indicated that the simulations adequately tested their knowledge and that they would recommend them to colleagues. Performance scores for data gathering were less than 70%, with no significant differences among the simulations. Case questions scores exceeded 80% and again were consistent among simulations, whereas therapy decision scores were more variable, with the lowest scores being recorded for antimicrobial-related simulations. Pharmacists with more hospital experience tended to perform better. Pharmacists completing a patient simulation program found the simulations to be worthwhile. Performance scores indicated some difficulty in gathering patient data and showed that correct therapeutic decisions may not always occur even if adequate information is obtained.

MacLeod M, Costello G. Improving education through computer-based training. Nursing Management 1994; 25(7): 86,88.
Summary: This paper was written to discuss the use of computer-based training (CBT) as an improvement over traditional methods of instruction. The types of assistance provided by CBT include 1) routines and brief tutorials, 2) computer-managed integration of text books, video, lab books and other media, 3) stand-alone applications using the computer to teach a concept, principle, relationship, procedure or other set of skills or knowledge, 4) simulators designed to move from controlled situations to those which emulate a real-world environment. CBT can reduce costs or improve the effectiveness of training. Some examples include: pre-selecting workers and/or trainees; testing for prerequisite skills or knowledge; learning prerequisite or pre-course content such as facts, concepts and principles to perform a job; teaching cognitive skills knowledge; developing psychomotor skills and affective skills; using simulation and advanced practice; CBT becomes very economical where training content is stable or where trainees are disbursed over a wide geographic area, through reduced training time and student travel time; CBT can ensure that all students receive the same instruction, regardless of location or quality of instructor.

Manning PR, Petit DW. The past, present and future of continuing medical education. JAMA 1987; 258(24): 3542-3546.
Abstract: Changes in CME during the past three decades have been controversial and complex. A 1950s-style, small-scale, voluntary activity has evolved, in 1987, into broad- scale programs with accredited sponsors and with ties to relicensure. Within the next three decades, CME will be directed by methods chosen by specialty boards for recertification and by exploitation of computer and telecommunication technology. Written recertification examinations can waste physicians' time studying material that will not improve care of their patients. We hope improved methods of analysis of individual practices, on-the-spot access to pertinent medical information and better communication among physicians can be incorporated into recertification procedures. Policies established now will shape CME for decades to come. We encourage a coordinated effort by medical specialty boards, medical societies, hospitals, medical schools, computer corporations, telecommunication firms, granting agencies and the National Library of Medicine to ensure the most effective and efficient recertification and CME policies.

Marks-Maran D. Using technology for distance. Nursing times Learning Curve 1998; 1(12): 14-15.
Summary: Internet-based distance education is in its infancy. As technology continues to develop and accessibility to the Internet grows, so too will delivery of educational materials via the Internet. In the meantime, the Wolfson Institute is taking the opportunity to learn how to harness this technology for educational purposes and to prepare for a future where education and technology move even

closer together. The author provides steps in the development of a distance learning program, the advantages of a comprehensive website and the criteria which should be used to organize support for distance learning students.

Masse Holbert C, Sudia Robinson TM. Computer applications for staff education, Part II. Neonatal Network 1992; 11(8): 69-70.
Summary: This column was written to update NICU nurses about educational applications of computer technology. This article focuses on the interactive videodisc. The interactive videodisc allows the development of a CAI program that has both the interactive capability of the computer and the audiovisual capabilities of the videodisc. This advantage provides a more realistic and engaging clinical scenario. The greatest advantage is that nurses can practice clinical decision making without compromising patient safety. A primary disadvantage of using the interactive videodisc is that nursing, at this time, have very few quality programs available.

Masten Y, Conover KP. Automated continuing education and patient education. Computers in Nursing 1990; 8(4): 144-150.
Summary: This article discusses the use of a computer network to provide instruction for health care providers and patients and provides examples of screens from the educational modules developed for the project. The continuing nursing education and patient education modules were developed as a portion of the components for KARENET (Kellogg Affiliated Remote Environments Network), linking rural Morton, Texas and the Health Sciences Center at Lubbock, Texas. Both health care providers and patient participants are benefitting from knowledge provided by the methodology of CAI/CMI provided by the network.

Masys DR. Advances in information technology. Implications for medical education. Western Journal of Medicine 1998; 168: 341-347.
Abstract: Few kinds of technology have had as broad an impact on the recent affairs of humanity as have information technologies. The appearance and rapid spread in the past several years of innovations such as the Internet's World Wide Web and the emergence of computer networks connecting tens to hundreds of millions of people worldwide have occurred with startling rapidity. These global events portend substantial changes in the delivery of health care, the conduct of biomedical research and the undergraduate, graduate and continuing education of health professionals. This report will attempt to succinctly review the following: (1) the characteristics of modern information technologies and recent trends that are most relevant to medical education and to the world in which future practitioners, researchers and educators will live and work; (2) the implications of these technologies for the development of educational goals (in other words, the specific information technology skills that

future health professionals will need); (3) the issues associated with the use of these technologies in the process of education; and (4) implications for near-term action by University of California medical schools and academic medical centers.

McDonald CJ. Computer technology and continuing medical education. A scenario for the future. MOBIUS 1983; 3(2): 7-12.
Abstract: This paper makes a clear and significant distinction between the educational approach for the student and the experienced practitioner. The role of the computer in the educational process is emphasized without making premature claims about its ultimate contributions. Included is a clear description of how the advanced computer system in our institution is currently assisting physicians in patient care. The clear delineation made between "informational support" and "decisional support" systems should be very helpful to those educators who are endeavoring to anticipate the future role of the computer in education.

McEnery KW. The Internet, World, Wide Web and Mosaic: An overview. American Journal of Roentgenology 1995; 164(2): 469-73.
Abstract: Technology is revolutionizing education. Global networks, powerful personal computers and user friendly, graphically oriented software are creating a new infrastructure that promotes rapid, efficient access to information. Images, text, audio and video can be integrated into interactive multimedia presentations, providing a hierarchy of knowledge that can be traversed by the click of a mouse. The extensive use of images in our arena makes radiologic education a major beneficiary. Because the components (text, images) of educational presentations are stored electronically on a network rather than on the printed page, an individual component can be linked and bundled into as many different presentations as desired. Furthermore, components of information can exist on different computers throughout the world and yet be linked by software into a single presentation.

McEnery KW, Grossman JE. E-mail access to NetCME: Implementation of the server push paradigm. AMIA Annual Fall Symposium 1997: 693-7.
Abstract: We describe the implementation of a Continuing Medical Education project which utilizes e-mail delivery of HTML documents to facilitate participant access to case material. HTML e-mail is displayed directly within the e-mail reader of the Netscape browser. This system of proactive educational content delivery ensures simultaneous distribution to all participants. Although a more effective method of content distribution, the system preserves user confidentiality and maintains security. HTML e-mail is non-proprietary and could be integrated into existing Internet-based educational projects to facilitate user access.

McEnery KW, Roth SM, Walkup RV. Radiology CME on the web using secure document transfer and internationally distributed image servers. Proceedings AMIA Annual Fall Symposium 1996: 37-40.
Abstract: We describe the implementation of a World Wide Web-based Continuing Medical Education (CME) program in Diagnostic Radiology which allows accumulation of Category 1 credit. The program implements an unknown case presentation format, which includes multiple choice questions, didactic information and literature references with links to abstracts. Physician participation is anticipated to occur in brief sessions during which the program automatically tracks CME credit accumulation. To allow an interactive presentation, HTML electronic form documents are created "on-the-fly" by a Common Gateway Interface (CGI) application interfacing with several relational databases. The system is scaleable with bandwidth intensive image transfers distributed over multiple internationally distributed image servers. For CME participants, the system utilizes document encryption to ensure confidential physician interactions.

Messmer PR, Kurtyka D, Kellley CPT. A theory-based computer training program. Journal of Nursing Staff Development 1992; 8(3): 136-8.
Summary: The authors report on the use of Kolb's learning theory as a method for implementing a computer training program. A variety of teaching strategies were developed which provided an environment for nurses and other health care providers with different learning styles to understand and use the computer system successfully. The comprehensive training program was critical to the successful conversion to a new computer system in a large public teaching hospital. This project reinforces the need for nursing education and research departments to use teaching strategies that accommodate a variety of learning styles in a heterogenous group. The results of this project suggest one approach to stimulate adult learning and facilitate an effective learning environment. Nurses and other computer users have demonstrated effectiveness of this training program through successful activation of the new computer system.

Millership JS. Computers in pharmacy. International Pharmacy Journal 1988; 2(2): 50-53.
Abstract: The utilisation of computers in community, hospital and industrial pharmacy is reviewed. Computer-assisted learning methods in academia and hospital pharmacy are discussed. The review concentrates mainly on the use of microcomputers although applications involving mini- and main-frame computers are also described. Microcomputers are now used extensively in academic institutions for computer-assisted learning. The computer allows the use of graphics and statistics as educational tools. Computers also play a vital role in the discovery, development and analysis of new drugs. Computers in pharmacy practice lead to reduced stock value, improved stock availability and a reduction in patient waiting times. The computer

also aids in stock control, labelling, patient records, drug interaction alerts and ordering.

Mottram DR, Rowe PH, Stanley IM. An evaluation of Enpharm, a computer-assisted learning program for pharmacists. The International Journal of Pharmacy Practice 1993; 2: 31-34.
Abstract: Enpharm is a computer assisted learning program for pharmacists. It is based on case studies which occur in community practice. Pharmacists using the program respond to cases presented by free-text entry, then compare their input with that of a peer group of 76 community pharmacists. There has been a high level of demand for the package. Many of the packages requested are used by pharmacists other than those making the original request. This paper presents an analysis of 100 evaluation questionnaires that were sent out with the package then returned to the authors. The analysis focused on the profile of users, when the program was used and pharmacists' perceptions of the value of Enpharm as a method of continuing education. Pharmacists using the program were mainly in full-time community practice. Half used a work-based computer, the other half used a computer at home. Difficulties in loading the software were rare and were confined to incompatibilities with hardware or to corruption of software during transit. Patterns of use varied but the majority spent between 16 and 30 minutes, on average, per session. The case studies were perceived to be realistic to community practice and although, in general, no new ideas were evident, the cases provided a valuable refresher on the points raised. Enpharm was judged overwhelmingly to be a form of continuing education which would be of benefit to other pharmacists.

Murray PJ. Distance learning for nurses' education: the role of the Internet. Nursing Standard Online 1196; 10(52): 1-7.
Summary: The Internet and the Web'provide enormous opportunities for providing distance learning opportunities for nurses. Existing Internet and Web-based facilities have the capacity to extend the ways in which course material is presented, to enhance teaching and learning methods and to introduce changes in the process of learning itself. This will apply not only to distance education offered by institutions, but also to nurses' self-directed study to meet statutory updating requirements. While we need to acknowledge the cautionary notes sounded by Dowd (1996) and not be 'swamped by the apparent magic of technology' (p71), there are exciting times ahead for distance education and for nurses with the vision to seize the opportunities.

Murray PJ. E-discourse and continuing professional education: the fusion of nursing knowledge and informatics to close the theory-practice gap. Studies in Health Technology and Informatics 1997; 46: 442-7.

Abstract: Several modes of electronic discourse (e-discourse) are currently used by nurses and have potential for meeting their formal and informal continuing professional education (CPE) needs. After defining e-discourse in relation to computer-mediated communications (CMC), the author outlines some recent examples of it use. T here follows discussion of the argument that, through e-discourse, nurses can reflect on their practice, incorporating and developing theory and meet their CPE needs. Some important constraining issues are presented and the author suggests that, for many nurses, e-discourse will have more educational application than multimedia in the foreseeable future. The paper is set within the context of UK requirements, but the issues raised are pertinent to nurses around the world, particularly where CPE is incorporated within the re-registration cycle.

Neafsey PJ. Computer-assisted instruction for home study: A new venture for continuing education programs in nursing. The Journal of Continuing Education in Nursing 1997; 28(4): 164-172.
Abstract: Background: Advanced practice nurses (APNs) tested a 5-contact hour home-study computer assisted instructional (CAI) program in pharmacokinetics developed by the author. Method: Twenty-seven APNs enrolled in a traditional lecture continuing education course in pharmacology participated in the study. The APNs were given a knowledge test and self-efficacy questionnaire before using the CAI program and again at the completion of program use. Results: Significant gains in knowledge and self-efficacy with large effect sizes were achieved by the program users. They cited the convenience, organization and simplicity of use, graphic animations and interactive question sequences as advantages of the program. Conclusion: Home study by computer may be a feasible option to printed home-study and lecture-based continuing education programs in nursing.

Neafsey PJ. Immediate and enduring changes in knowledge and self-efficacy in APNs following computer assisted home study of the pharmacology of alcohol. The Journal of Continuing Education in Nursing 1998; 29(4): 173-181.
Abstract: Background: 18 advanced nurse practitioners (APNs) evaluated a two contact hour home-study computer-assisted instructional (CAI) program on the pharmacology of alcohol developed by the author. Changes in knowledge and self-efficacy were measured immediately following program use and five months later. Method: the APNs were recruited from two seminar sections of a traditional lecture-based continuing education course for nurses enrolled in a primary care nurse practitioner program. P articipants completed cognitive and self-efficacy instruments in class pre-program use and 5 months post-program use. The APNs completed immediate post-program evaluation instruments at home and returned them by mail. Results: Significant gains in knowledge and self-efficacy with large effect sizes were achieved immediately following program use. Cognitive and self-efficacy scores decayed significantly 5 months post-program use but were still significantly greater

than pre-program scores. Conclusions: These findings indicate that continuing education in substance misuse or other pharmacology content may be effectively implemented at home via CAI.

Nerlich S. Computer-assisted learning (CAL) for general and specialist nursing education. Australian Critical Care 1995; 8(3): 23-7.
Abstract: Computer-assisted learning (CAL) may be defined as any learning that is mediated by a computer and which requires no direct interaction between the user and a human instructor in order to run. Instead, CAL presents the user with an interface (constructed by an educator skilled in the field of study) which allows the user to follow a lesson plan or may allow self-directed access to particular information of interest. CAL has been claimed to improve knowledge retention and achievement scores, enhance clinical judgement skills and reduce required instruction time; performing as well (if not better) when compared to other more traditional education techniques. The advantages of the utilisation of CAL in nursing education can be made clear by consideration of adult education theory and curriculum design, as well as the particular learning needs of nurses themselves. Research and development into a theoretical framework for CAL design and implementation has allowed the identification of beneficial aspects of CAL resources. Although the cost of commercial software may be prohibitive to some institutions, possibilities exist for educators to create their own CAL packages relatively simply.

O'Toole MT. Evaluating instructional software. Nursing Dynamics 1993; 2(2): 17, 19-20.
Summary: The selection of software to meet staff education needs is facilitated by making practical, systematic evaluations of the available programs. The first concern should be whether or not the software will run on any already available computer systems. The configuration of the computer systems also matters. Most computer systems in a hospital are networked and this setup may affect the software program you are intending to purchase. The next concern involves the cost and support of the program. Educational software can provide a cost-effective, flexible and meaningful tool for staff education. But the initial cost of setting up computer programs can be quite large and therefore should be thoroughly researched before being brought to the attention of the department head. Previewing the software via a trial period offered by the manufacturer is a wise step in the development of your case. Specialty journals are also beginning to include reviews of software, which can provide information on how the product rates in comparison to other programs on the market. It is also important to consider how much support is offered from the manufacturer after the purchase of the program. Another good idea is to seek input from individuals who will be directly involved in the use of the program.

Ostbye T. An 'Electronic' extramural course in epidemiology and medical statistics. International Journal of Epidemiology 1989; 18(1): 275-279.
Abstract: This article describes an extramural university course in epidemiology and medical statistics taught using a computer conferencing system, microcomputers and data communications. Computer conferencing was shown to be a powerful, yet quite easily mastered, vehicle for distance education. It allows health personnel unable to attend regular classes due to geographical or time constraints, to take part in an interactive learning environment at low cost. This overcomes part of the intellectual and social isolation associated with traditional correspondence courses. Teaching of epidemiology and medical statistics is well suited to computer conferencing, even if the asynchronicity of the medium makes discussion of the most complex statistical concepts a little cumbersome. Computer conferencing may also prove to be a useful tool for teaching other medical and health related subjects.

Palmer TEA, Cumpston PVH, Ruskin K, Jones RDM. WCALive: broadcasting a major medical conference on the Internet. International Journal of Clinical Monitoring and Computing 1997; 14: 209-216.
Abstract: Live video and sound from the 11th World Congress of Anaesthesiology in Sydney, Australia were broadcast over the Internet using the CuSeeme software package as part of an ongoing evaluation of Internet-based telecommunication in the delivery of Continuing Medical Education (CME). This was the first time such a broadcast had been attempted from a medical convention. The broadcast lasted for four days, during which a functioning combination of computer hardware and software was established. Technical issues relating to broadcast of these real time signals over ISDN links and the Internet itself were addressed. Over 200 anaesthetists from around the world were able to 'attend' the plenary sessions via the Internet. Evidenced by feedback received audio reception was quite good. Video reception was less successful for those receiving the broadcast via a modem based Internet connection. The received signal in such circumstances was adequate to provide a video presence of the speaker but inadequate to allow details of 35 mm slides to be visualised. We conclude that this technology will be of use in the delivery of CME materials to remote areas provided simultaneous viewing of high resolution still images is possible using another medium, such as the World Wide Web.

Pankaskie M, Sullivan J. Online learning: trends in continuing education. Journal of the American Pharmaceutical Association 1998; 38 (3): 382.
Summary: This paper was written to discuss the advantages of computer-assisted CE material versus traditional media, as well as some of the issues that have yet to be resolved. Computer-assisted CE can be defined as any package or program that requires a personal computer. There are four main categories: 1) documents distributed as computer-readable files on a CD or diskette, 2) software installed on

the user's local computer, 3) shared programs that can be downloaded from a network and run on the users computer, 4) online programs installed on a remote computer but controlled by user input from their local computer. The advantages and disadvantages of continuing education via the net are discussed.

Parker JE. A statewide computer interactive videodisc learning system for Florida's CMS nurses. Computers in Nursing 1984; 2(2): 24-30.
Abstract: Nurses working in Florida's Children's Medical Services (CMS) update their case management skills using computer-based training modules. Microcomputers, interfaced with a videodisc player, allow nurses to select what they want to learn and when they want to learn it, right in their work environment. The problems and benefits of a statewide computer-based instructional system are discussed, along with the practical issues involved in implementing such a system.

Parry Bush AM. Computer-based training: Training approach of choice. Computers in Nursing 1993; 11(4): 163-164.
Summary: This study was designed to implement the use of a computer based training (CBT) program to train more than 1400 staff members to use the ProTouch software system. Staff could do the training at work or take the CBT discs home. Benefits of using the CBT are: 1) allowed the learner to learn at his/her own pace and at a time which was best for the learner; 2) the CBT would use practice scenarios to emulate the "live" system; 3) the CBT would provide the user with the ability to learn small pieces of information at several sittings by offering a feature called "bookmark"; 4) the CBT included a standardized test to determine learner proficiency. The mastery test used both simulations and questions to verify the learner's competence. A survey was also used as an evaluation of the type of training. Survey responses overall were positive. There were some modifications to the CBT based on both survey and alpha unit recommendations. There were no test scores provided or no statement pertaining to the effect on learning.

Pease C. The Internet and education go hand-in-hand. California Pharmacist 1997; 44(3): 27-28.
Summary: The purpose of this article is to introduce some of the opportunities available to pharmacists via the Internet. Pharmacists are now able to obtain accredited education and increase their professional development via the Internet. The value of using the Internet is found in its flexibility, accessibility and ease of use. The author also mentions the use of Internet Relay Chat (IRC) which is a live chat session between various users of the Internet who converse on "channels". IRC is now available in some distance continuing education courses allowing participants to converse with numerous colleagues over the Internet.

Pengov RE, Wright JC, Forman MH. The use of computer assisted instruction in the core content review for family physicians. Technological Horizons in Education 1979; 6(4): 45-7.
Abstract: New methods of recertification and continuing education of Family Physicians are needed nationally. A test of a computer application is presented as an approach to increased effectiveness. Fifty-seven family physicians and residents participated in a program, which offered a portion of the Core Content Review (CCR) of family medicine online. User performance, user perception of the value of the CAI CCR and user attitude toward and acceptance of the CAI medium of delivery were examined. All participants were given a post-program exam and an attitudinal questionnaire. The Ohio CAI scores were not significantly different from the Ohio "Pen and Paper" CCR scores. The majority of participants rated their experience and satisfaction, as well as the appropriateness of the CAI CCR as "Excellent" or "Good". The CAI CCR course was preferred over the pen and paper test by 71.2% of respondents and 67% of all respondents indicated that given the opportunity they would take another CAI CCR. A small majority felt it would be beneficial to make the entire CCR available via CAI.

Petlin AM. Computer-based ACLS training: One year's experience with Actronics. Nursing Staff Development Insider 1994; 3(1): 3.
Summary: In this paper the author describes the application of an Actronics computer learning system to provide certification and recertification in advanced cardiac life support (ACLS). The Actronics package includes the computer with CD-ROM and laser disc players, a printer, keyboard and mouse and electronic adult, infant and intubation manikins for skills practice and testing. The program allows the students to work at their own pace and feedback is provided at the end of each lesson and after testing. Another advantage of having this type of system is that the course is always available. The major problem encountered revolved around staff members' lack of computer skills. Skills and knowledge retention seems to be as good as that from traditional ACLS classes. The author estimates that the system will show savings in about 2 years.

Petrie LC, Lippman G. Pharmacy education goes multimedia. Computer Talk for the Pharmacist 1994; 14: 12-14.
Summary: As healthcare reform asks for even greater clinical involvement from pharmacists, multimedia applications are being developed to help pharmacists meet the challenges of the future and be recognized as valuable members of the healthcare team. The CD-ROM offers the opportunity to learn material at your own pace and it can provide information on demand in understandable and usable formats. Pharmacists can also use this technology to educate patients about their conditions, which usually results in better patient compliance. CD-ROMs offer 650-megabyte capacities and they can combine text, sound, video and animation which is controlled,

coordinated and delivered via computer. CD-ROMs provide the most convenient way to store and access larger quantities of digital information. Multimedia technologies are also proving to be a more cost efficient method of accessing information especially when the information is used by large numbers of professionals and patients over extended periods of time.

Petzinger Kaplan I, Radonic Patton L, Hamilton RA. Adaptation of different computerized methods of distance learning to an external PharmD degree program. American Journal of Pharmaceutical Education 1996; 60: 422-425.
Abstract: The Journal Club component of Drug Information/Literature Evaluation/Biostatistics, a required course in the Doctor of Pharmacy program, has been conducted online for students in the nontraditional program for three semesters. The New Jersey Institute of Technology (NJIT) Electronic Information Exchange System (EIES) Virtual Classroom™ was used for the first semester. Wildcat! Was used for the subsequent semesters, first via dial-up modem and then via and Internet connection. Students interacted well on both systems, with skills improving over the course of the semester. Students felt more "attached" to the College and to the class than in previous distance learning courses as a result of their computer participation.

Piemme TE. Computer-assisted learning and evaluation in medicine. JAMA 1988; 260(3): 367-372.
Abstract: The use of the computer in medical education has been in evolutionary development since the early 1960s; its adoption, however, has been less widespread than the promise of the medium should warrant. Computer-assisted instruction enhances learning, allowing the student the discretion of content, time, place and pace of instruction. Information conveyed can take several forms, some better suited to undergraduate medical education, others more applicable to graduate and continuing education. The use of the computer in certification and leisure could, within a decade, transform the way competence is assessed. Its greatest promise, however, may lie in providing pertinent information at the time when and in the place where, patient care takes place. New developments in data storage and retrieval forecast applications that could not have been imagined even a year or two ago. This paper discusses the development of computer assisted instruction in medical education over the past 25 years, CAI in medical education today and the future of the computer in medical education.

Plank RK. Nursing online for continuing education credit. The Journal of Continuing Education in Nursing 1998; 29(4): 165-172.
Abstract: Background: The Internet was evaluated as a source of continuing education credit for RNs. Method: Using the search engines Alta Vista, Excite, Magellan and Infoseek, 600 World Wide Web sites were reviewed for online

programs that would lead to the receipt of a continuing education (CE) certificate of completion for a varying number of CE hours. Results: Five sites provided CE programs online and one site used e-mail to deliver the program to personal computers. All sites offered certificates and were approved to offer continuing nursing education through a state board of nursing or through the agency sponsoring the Internet site. The CE hours were also approved by the American Nurses Credentialing Center's Commission on Accreditation. Conclusion: The findings indicate the Internet is a source of CE units (hours) for nurses that may be used to satisfy requirements of state boards of nursing. The sites are easily accessible and eliminate travel and great expenses. The Internet is a rich source of current health related information not approved for CE units but pertinent to health care professionals.

Pogue LM. Computer-assisted instruction in the continuing education process. Topics in Clinical Nursing 1982; 4: 41-50.
Summary: Staff development educators are faced with the problem of providing educational offerings in increasing numbers of content areas, to busy nurses with diverse educational backgrounds and clinical experiences. The microcomputer has the capability of assisting adult learners in their continuing education efforts by providing individualized and self-paced instruction at a time and place that are most convenient for them.

Posel N. Guidelines for the evaluation of instructional software by hospital nursing departments. Computers in Nursing 1993; 11(6): 273-276.
Abstract: Hospital nursing departments are becoming more receptive to the use of computer assisted instruction to facilitate and augment educational requisites for both staff and client. Numerous guidelines exist for software assessment, but none has been devised specifically for the often inexperienced hospital nursing committee charged with software review. This paper introduces the Hospital Oriented Instructional Software Evaluation, guidelines developed specifically for hospital use.

Poss R, Koris M, Santore R, Mevis H. Computer applications for orthopaedic surgeons: CD-ROM and beyond. International Course Lectures 1995; 44: 519-26.
Summary: This paper was written to discuss the impact of the computer on orthopaedic surgeons. The key is to purchase as much technology as you can afford, buy today's best technology. Top of the line equipment will be adequate for a longer period of time and will likely be upgradeable. With the availability of both multimedia computer systems and high-speed computer links, the potential for accessing data and images interactively from around the world has become a reality. Literature-search databases, bulletin boards for information acquisition and travel planning and teleconsultation are examples of services that can be accessed by the

othhopaedic surgeon who has access to a personal computer and a modem. Discussion forums dedicated to specific topics in industry or research are clearinghouses for up-to-date information. The authors go on to give brief descriptions of parity, cyclical redundancy check (CRC), networking, e-mail and other technical considerations that may be of interest to surgeons interested in buying or using a personal computer for CE.

Price MR, Reis Wieczorek R. Nursing multimedia interactive center for excellence in education: Cost-effective answers in financially stressed hospitals. Nursing Leadership Forum 1995; 1(4): 138-145.
Summary: This paper describes one hospital's efforts to transform a traditional staff education model into a multimedia learning center. The authors offer the following critical points to remember when changing to a high-tech instructional delivery model:
identify the hardware and software resources available for your use; identify human resources and meet with those responsible for the purchase, management and /or development of educational materials and network information systems; purchase a file server for storing nursing education software, this will allow you to provide instruction at the unit level and interface with your hospital information system; identify the hardware and software you will need for a local area network or to network with your hospital network; obtain written approval and validation from your information systems department, verifying network computability and the completeness of your list of intended hardware and software purchases; establish a computer taskforce committee with representation from your department of education, clinical information systems and outside network consultants; involve instructors in software selection, evaluation and curriculum integration; develop guidelines for the lab and use of all of its resources; conduct ongoing software and hardware orientation workshops for instructors; introduce staff and administration to computer resources.

Reed FC, Collart ME, Ertel PY. Computer assisted instruction for continued learning. American Journal of Nursing 1972; 72(11): 2035-2039.
Summary: In this report the authors discuss the application of computer-assisted instruction to continuing education for nurses. The authors begin the paper by pointing out the need for continuing education and the difficulties in establishing effective and useful educational programs. Computer-assisted instruction is a highly individualized mode of learning that can be tailored to meet individual needs and can also offer a great number of options and responses. In order to incorporate CAI into an educational program, instructors need to be competent in both the educational and technological aspects of course development and delivery. Advantages of CAI discussed by the authors include: alleviates scheduling problems, its available 24 hours a day; convenient; can start and stop at any time, picking up where you left off;

instructors can obtain reports of student progress at any time; tirelessly performs repetitive teaching tasks, freeing up instructor time for more clinical or skill issues; can be cost-efficient; allows learner to be independent and self-directing; individualization is achieved through branching and active participation in the learning process; immediate feedback is provided; diversity in authorship.

Richardson ML, Norris TE. Online delivery of continuing medical education over the World-Wide Web: an online needs assessment. American Journal of Roentgenology 1997; 168(5): 1161-4.
Summary: Objective: Online continuing medical education (CME) courses offer at least two potential advantages: they are extremely convenient and relatively inexpensive. Before expanding our department's 2-year-old online Category I accredited CME program, we conducted a survey to assess the need for more courses of this type and to document those topics of most interest to our responders. Materials and Methods: An online survey form was designed and linked to the home page of our departmental Web server. The 8-month survey asked whether respondents were interested in earning Category I CME hours, how many hours they desired, how much were they willing to pay for each hour and which topics would interest them most. Responders were also asked to specify their medical practice and medical specialty. All responses were tabulated and simple descriptive statistics were calculated. Results: Our survey received 317 responses, 188 from physicians, 42 from radiology technologists, 11 from physician assistants and nurse practitioners and the remainder from 26 other categories of practice. Physician specialties identified included 86 diagnostic radiologists, 24 internists, 18 emergency medicine specialists, 15 family practitioners and 45 from 14 other specialties. Responses came mainly from the United States, however 32 responses were received from 15 other countries. The median number of online CME hours desired was 15 (range 1-1324). Physician responders were willing to pay a median amount of $10 per credit hour (range $0-$400). The most commonly suggested topic was general radiology, followed by general reviews of MR imaging, CT. sonography and various organ-based specialties in radiology such as mammography, neuroradiology and musculoskeletal radiology. Conclusion: Physicians and many other health care workers are interested in online CME and are willing to pay for such a service. This information, as well as the suggested topics collected in this survey, may prove helpful in planning future offerings of online CME.

Roberts C, Fox N. General practitioners and the Internet: modeling a 'virtual community'. Family Practice 1998; 15(3): 211-215.
Abstract: Background: Electronic discussion lists are used by many groups, including GPs, for communication and information sharing. The technology offers potential for formal learning and professional development. Various models have been proposed to describe the dynamics of such 'virtual' forums and research is

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required to explore how such a discussion list might support professional development. Objective: We aimed to explore the use of the Internet-based discussion group gp-uk by GPs and their colleagues. Methods: We carried out a qualitative study of the electronic text generated by GPs and colleagues on an academic medical discussion group. Results: The list gp-uk has features of a collaborative medium, in which the audience are also contributors. There is support for a 'critical mass' model, in which a relatively small number of members contribute on a regular basis. There is little support for a 'discretionary database' model of more formal sharing of specific factual information. Conclusions: The findings indicate a model for a 'virtual classroom' for computer-mediated learning and professional development. A critical mass of participants is a requisite, the list should be facilitated to guide discussions and supporting resources such as an Internet web-site should be provided.

Robertson R. RHSETNet. Informatics in Health Care 1994; 3(5): 219-220.
Summary: The purpose of this article is to discuss the development and feasibility of delivering education and training programs to rural health workers using the AARNet for the Rural Health Support, Education and Training Program (RHSET). The project supports opportunities to enhance professional and vocational development through the use of electronic mail (email), Gopher and World Wide Web (global data bases) and public access library catalogues. To help health professionals become competent in using this technology three strategies were used consisting of: 1) a guide that featured step-by-step instructions, 2) a telephone "hotline", and 3) there were some training sessions provided on site. An evaluation instrument was included to ensure effectiveness and usefulness of the program. This program has allowed rural health care workers to access information and participate and share in electronic conferences that were previously only available in city computing facilities.

Rodriguez L, Petryshen P, Petryshen P, Pelekis G. Multimedia applications in nursing for computer-based staff training and patient education. The Journal of Continuing Education in Nursing 1992; 23(3): 140-142.
Summary: Technological advances have offered innovative ways to train practitioners and educate patients. Advancements in hardware and software are making multimedia more sophisticated, affordable and accessible to the average PC user. It is now practical for nurse educators to design their own learning materials for their staff and for patient education. This paper provides a hypothetical course explaining some of the features (feedback, evaluation, simulations, etc.) that should be included in a good learning program. Computer companies are providing the technology enabling the incorporation of multimedia learning applications in health care. The challenge for health care educators is to "actualize" the powerful potential of this technology.

Rosser J. CD-ROM multimedia. The step before virtual reality. Surgical Endoscopy 1996; 10(10): 1033-1035.
Abstract: Applications developed using key multimedia elements are finding their way into a number of training and information exchange environments including the laparoscopy training market. Emerging multimedia-based applications range from procedural information for patients to interactive CD-ROM-based applications used to train highly skilled surgeons. These products are designed with a high level of interactivity that allows the surgeon to plan a surgical procedure, review detailed patient information and then merge that information into the surgical planning process. Using this new technology, a surgeon now has the ability to review CD-ROM-based course materials and efficiently meet continuing education requirements. The factor found most limiting in the development of multimedia-based applications for laparoscopy training is generally not the technology, but the limits placed on the technology because of one's reluctance to think beyond what is accepted as the norm. Properly implemented, multimedia applications developed for laparoscopy training reduce the cost and time associated with learning new materials, assist a user in retaining more of the information reviewed and in many cases make the learning experience much more enjoyable.

Ruskin KJ, Doyle DJ, Engel TP. Symposium: A clinician's guide to the Internet. Development of an Academic Internet resource. Yale Journal of Biology and Medicine 1996; 69: 439-444.
Abstract: Networked electronic publication is a relatively new development that has already begun to change the way in which medical information is exchanged. Electronic publications can present ideas that would be impossible in printed text, using multimedia components such as sound and movies. Physicians who use the World Wide Web (WWW) on a regular basis may recognize the value of electronic publication and decide to become information providers. Nearly anyone with a computer and modem can create a WWW resource on a Web server at a hospital or on a commercial hosting service. Medical publication on the Internet demands a high level of quality control because the information will be available to anyone who cares to look. Creating a peer-review system for electronic information may, therefore, help to enhance academic recognition of Internet medical resources. Resources containing medical information must be continually available and protected from system failures and unauthorized access. As Internet technology matures and these problems are solved, electronic publication may become the predominant method of communication between medical professionals.

Ruskin KJ, Palmer TEA, Hagenouw RRPM, Lack A, Dunninn R. Internet teleconferencing as a clinical tool for anesthesiologists. Journal of Clinical Monitoring and Computing 1998; 14: 183-189.

Abstract: Internet teleconferencing software can be used to hold "virtual" meetings, during which participants around the world can share ideas. A core group of anesthetic medical practitioners, largely consisting of the Society for Advanced Telecommunications in Anesthesia (SATA), has begun to hold regularly scheduled "virtual grand rounds". This paper examines currently available software and offers impressions of our own early experiences with this technology. Two teleconferencing systems have been used: White Pine Software CU-SeeMe and Microsoft NetMeeting. While both provided acceptable results, each had specific advantages and disadvantages. CU-SeeMe is easier to use when conferences include more than two participants. NetMeeting provides higher quality audio and video signals under crowded network conditions and is better for conferences with only two participants. While some effort is necessary to get these teleconferencing systems to work well, we have been using desktop conferencing for six months to hold virtual Internet meetings. The sound and video images produced by Internet teleconferencing software are inferior to dedicated point-to-point teleconferencing systems. However, low cost, wide availability and ease of use make this technology a potentially valuable tool for clinicians and researchers.

Russin MM, Davis JH. Continuing education electronic bulletin board system: provider readiness and interest. The Journal of Continuing Education in Nursing 1990; 21(1): 23-7.
Abstract: This study explored the feasibility of establishing a computer-based, statewide electronic bulletin system (BBS) for continuing education for nurses in Florida. An anonymous survey addressing the feasibility of instituting such a BBS was mailed to a random stratified sample of 225 continuing education providers approved by the Florida Board of Nursing. The survey explored information services used and desired by providers, availability of resources to use a BBS, fees providers would be willing to pay and the degree of interest in participating in a BBS. The findings of this preliminary study suggest that although support for a BBS featuring continuing education for nurses may be emerging in Florida, two major impediments to the establishment of such a system currently exist: start up and maintenance costs and the nursing professions lack of preparedness.

Saleem N, Moses B. Expert systems as computer assisted instruction systems for nursing education and training. Computers in nursing 1994; 12(1): 35-45.
Abstract: The ever-increasing specialization of nursing care may require nursing professionals to provide nursing care outside of their specialty. Nurses will have to familiarize themselves with a new specialization area at short notice. Fortunately, expert-systems technology can prove particularly helpful in achieving this familiarity. As such, this technology can prove a valuable tool for education and training of nursing professionals and students. This article describes the unique edge that expert systems technology provides in this context. Using VP-Expert, an expert system

shell, the authors present two examples to illustrate the development of a computer aided instruction system and the unique benefits such a system offers.

Saterenen SG, Boyd C. Community hospital embraces high-tech training. Computers in Healthcare 1990; 11(8): 26-7.
Summary: An interactive videodisc system was purchased by the Mount Caramel East Hospital in Columbus. The following report describes the risks taken when purchasing such a system and the level of acceptance of the new technology. Acceptance of the interactive videodisc technology by the nursing education staff and by nurses has been excellent. Interactive videodisc programs are gradually being integrated into nursing education activities. The DxTER interactive programs are well-accepted by residents and medical students and are recommended for new critical care physicians and medical house physicians. This acceptance is boosted by the awarding of CME credits for physicians and contact hour credits for nurses.

Schmaus D. Computers in the OR. Evaluating computer-assisted instructional software for the OR. AORN Journal 1991; 54(6): 1296-1301.
Summary: Deciding to use CAI programs involves many factors, including budget considerations. Nurse educators need to be aware of how computers can be used within their own institution and how to evaluate and implement CAI programs. Computers are permanent fixtures in educational settings. If selected and used wisely, they can ease the frustrations and headaches in an educator's life.

Schramm M, Gollnick H. Continuous education for acne- basics, pathogenesis, differential diagnosis, clinic and therapy. Dermatology 1998; 196: 100-101.
Summary: A comprehensive interactive, hypermedia-based computer program on CD-ROM about acne and acne-related disorders was developed and adapted to the actual demands of knowledge acquisition. Because of its user-friendly and self-paced structure, no special computer knowledge is required for the use of the program. It provides fast access to required information on the topics of acne and acne-related disorders with special emphasis on integrated media. The authors think that computer-based educational applications for dermatology complement traditional teaching methods and offer distinct advantages over textbooks in their ability to display dynamic image sequences and reproduce images.

Schulz S, Schrader U, Klar R. Computer-based training and electronic publishing in the health sector: tools and trends. Methods of Information in Medicine 1997; 36: 149-53.
Abstract: CBT (computer-based training) applications and hypermedia publications are two different approaches to the utilisation of computers in medical education.

Medical CBT software continues to play a minor role in spite of the increasing availability, whereas hypermedia have become very popular through the World Wide Web (WWW). Based on the HTML format they can be designed by non-programmers using inexpensive tools while the production of CBT applications requires programming expertise. HTML documents can be easily developed to be distributed by a web-server or to run as local applications. In developed countries CBT and hypermedia have to compete with an abundance of printed or audio-visual media and a wealth of lectures, conferences, etc., whereas in developing countries these media are scarce and expensive. Here CBT programs and hypermedia publications in particular, may be a cost-effective way to improve quality of education in the health sector.

Sheridan M, LeGros E. Computer-assisted instruction using electronic mail. Journal of Nursing Staff Development 1995; 11(2): 100-103.
Abstract: A major challenge to nursing staff development departments is how to reach individual staff members with new information in a limited period of time. Attendance at classroom instruction is not always feasible. The use of electronic mail to provide instruction to learners can be an effective teaching strategy. Advantages are immediate accessibility to the learner and the opportunity to tailor the program to meet specific hospital requirements or individual learning needs. Tips on how to develop and send instructional modules through electronic mail are included in this article.

Shortliffe EH. Problems in implementing the computer for continuing education. MOBIUS 1983; 3(2): 52-55.
Summary: In this paper the author considers ways in which computer-based education might be more effectively integrated into clinical activities of the practicing physician. In traditional computer-aided instruction, the physician must seek out an educational package and set aside time, separate from his or her patient care activities, in which to run the program. The authors prefer the use of a computer as a consultant rather than as an educator per se. There are two models of how computer-based consultation can be offered. In the first model, the physician uses the computer for some other chore (e.g. test ordering or medical records manipulation) and the computer "monitors" for problems and offers advice that may be pertinent. An example is the PROMIS system. The second model is the development of programs to which physicians will turn because they specifically wish advice about a difficult management or diagnostic problem. An ability to explain decisions may be incorporated into computer-based decision aids, this addition may be an important step towards heightening a program's educational potential. Six design features that physicians rated as most important in future consultation systems: 1) ability to explain their diagnostic and treatment decisions to physician users; 2) they should be portable and flexible so that physicians can access them at any time and place; 3) they

should display an understanding of their own medical knowledge; 4) they should improve the cost efficiency of tests and therapies; 5) they should automatically learn new information when interacting with medical experts; 6) they should display common sense. Guidelines for the design of future consultation systems include: 1) designers should try to minimize changes to current clinical practices; 2) it is wise to concentrate some of the research effort on enhancing the interactive capabilities of the expert system (explanation, common sense, knowledge representation and usability); 3) system builders should recognize that for most problem areas, 100% accuracy is neither achievable nor expected; 4) when designing systems, it is wise to consider the concerns and demands that physicians express about consultation systems.

Sikorski R, Peters R. Tools for change: CME on the Internet. JAMA 1998; 280(11): 1013-1014.
Summary: This paper discusses some of the implications associated with the presence of CME on the Internet. The Net offers physicians new tools for identifying and locating CME courses that might be of interest and the opportunity to learn and earn credits completely online. The Internet also provides high-quality professional learning opportunities online and also presents the opportunity to interact with expert faculty, integrate newly published or otherwise available peer-reviewed scientific information and clinical developments and improve the process of taking courses and tracking credits. The degree to which physicians will actually embrace these new CME approaches remains unclear. Also unclear is what sorts of clinical issues might be better addressed in an online format than in other formats. The paper also provides a sample of the available online resources of CME courses on the net.

Smith RP. The Internet for continuing education. M.D. Computing 1997; 14(6): 414-6, 418, 420.
Summary: The focus of this paper is to provide a brief update on the use of the Internet for continuing education. The author also provides links to sites that provide access to Medline and other educational material. The most familiar use of the Internet in medicine is as a fast and efficient path for clinical reference. There are many sites that can provide access to the full text of articles in addition to citations. There are also specialized databases that contain a subset of the literature focusing on a specific subject. A number of sites offer lists of continuing education opportunities or directly provide education online.

Spooner SA. Online resources for pediatricians. Archives of Pediatric and Adolescent Medicine 1995; 149: 1160-1168.
Summary: Background: Medical information is increasingly available on computer networks. Objectives: To familiarize the pediatrician with some of the terms

associated with these online resources and to describe what is available via the Internet and dial-up computer bulletin boards. Data Sources: Information for this article was taken from publicly available online services and Internet servers. Data Extraction: Only resources relevant to pediatric practice were included. Data Synthesis: Medical information on the Internet is in a state of evolution. Useful resources for pediatricians are sparse but expanding rapidly. Conclusions: Pediatricians may use online computer networks to communicate. Familiarity with computer networks will become more important to pediatricians as electronic medical records, online medical literature and telemedicine (the practice of medicine over long distances) become more common. Medical libraries and commercial online services are good places to begin to investigate the availability of medical information over computer networks.

Storey PB. The future of computers in continuing medical education. MOBIUS 1983; 3(4): 56-63.
Summary: The purpose of this paper is to discuss the future application of computers in the physician practice. There are three main areas of the physician practice that will be affected by the computer revolution. These involve the use of computers in automating his/her practice, computer-assisted patient care, and computer-assisted continuing medical education. The author hypothetically discusses each of theses three areas in an attempt to project the way that computers will influence the physician's practice. This process will allow the conversion of learning materials from an area-oriented subject matter to a practice-oriented subject matter, thus relating CME to the individuals own practice.

Storey PB. Computers and education. MOBIUS 1986; 6(3): 25-30.
Summary: The purpose of this paper is to encourage physicians to incorporate computes into their daily practice to help mange their office and to recognize its potential for CME. There are four important aspects of integrating computers into daily practice: 1) to become more efficient in terms of the everyday management of the office, 2) access to major databases, 3) computer-assisted diagnosis and computer-assisted treatment, and 4) lifelong learning. The author discusses each of these aspects in brief detail, including a small list of CAI courses being developed and marketed. The author concludes by saying that the only way to become part of this trend is to own a computer and get wired into the world of computer-based telecommunications.

Sullivan BH. Linkages...Internet and the World Wide Web. Washington Nurse 1996; 26(5): 39.
Summary: In this paper the author introduces the Internet and World Wide Web as a means of enhancing the continuing education experience. The author suggests that

once nurses begin to explore this technology as a means learning and connecting with colleagues, they will wonder how they ever did without it. The advantages of this technology are as follows: It's utility -- you can access remote sites, download and print information you locate, view and listen to interactive educational files, search the entire world of online information for the exact match to your research topic, create archives of information you may need in the future, or jump from linked page to linked page of related topics; it's value -- it saves time and money, allows you to make connections with peers and it provides the opportunity to communicate and collaborate with nursing experts; it's immediacy -- you can obtain results in minutes; it's currency -- content is updated on the Web much more frequently than in hard copy publications; it's breadth and depth -- most healthcare and nursing specialties are covered in comprehensive detail.

Thompson WL, Dyke JP, Buonocore E. Using the World-Wide Web to train and certify physicians in the safe use of fluoroscopy. AJR 1996; 166: 1263-1264. *Abstract:* Objective: We sought to create a computer-generated certification examination that concurrently tests and educates fluoroscopy users. Materials and Methods: A trial examination was placed on the Internet for area physicians who requested fluoroscopic privileges at our institution. The name and address of each individual who achieves a passing score is automatically sent by e-mail to the examination administrator. Results: Physicians expressed widespread satisfaction with this certification process. The difference in number of attempts and score of the first attempt between groups of radiologists and nonradiologists favored the radiologists (p approximately .03 in both cases when analyzed using an unpaired t test. Conclusion: This examination ensures understanding of the procedural parameters that contribute to skin injury in patients and affords an easy approach to self-education.

Tinsley L, Easa D. Pulmonary diseases in the neonate: a computer-assisted instruction. Computer Methods and Programs in Biomedicine 1986; 22: 93-101. *Abstract:* This project consists of an interactive audiovisual learning program in respiratory disease in premature and term infants. It is directed towards the primary care physicians to help increase their knowledge base of neonatal pulmonary diseases. This program will teach common respiratory diseases seen in the sick newborn infant by way of interactive computer-assisted programs interfaced to a video display terminal showing such things as x-rays, laboratory findings and physical signs. The need for this type of program is shown by the increased population of infants born at high risk for respiratory diseases, as well as the centralization of high risk newborn care at the tertiary center, leaving many physicians without the experience or skill to stabilize and manage premature and term infants with respiratory problems. It is hypothesized that this method of instruction will be effective because of its accessibility and practicability.

Treistman J, Watson D, Fullerton J. Computer-mediated distributed learning. An innovative program design in midwifery education. Journal of Nurse-Midwifery 1996; 41(5): 389-392.
Abstract: The State University of New York, Stony Brook (SUNY-SB) Pathways to Midwifery Program offers a distributed learning curriculum that is unique among American nurse-midwifery education programs. The Pathways to Midwifery Program provides asynchronous, computer-mediated instruction. Community-based faculty coordinate, supervise and evaluate the clinical education of students. The SUNY-SB model offers an opportunity to increase dramatically the number of students who can receive the curriculum. It also provides distinct advantages in maintaining a curriculum database that reflects rapidly changing clinical science and that takes advantage of vast educational resources available through related computer networks. By creating a classroom without walls, the program is cost-effective.

Tronni C, Prawlucki P. Designing a computer-based clinical learning lab for staff nurses. Computers in Nursing 1998; 16(3): 147-149.
Summary: The purpose of this paper is to discuss the establishment of a computer-based clinical learning lab (CLL) to address the continuing education needs of nurses. This lab operates on a 24-hour basis and focuses on orientation, mandatory training requirements, ongoing education and professional development of nurses. The considerations addressed in setting up the CLL included: 1) task force development, 2) funding, 3) space, 4) software and hardware selection, 5) security, 6) operational guidelines, 7) implementation and 8) evaluation. The development of this lab has provided the nursing staff with more flexibility, more options and more control in meeting their needs. It has also raised staff learning, motivation and professionalism.

Tynan P. Using the Internet in critical care nursing. Australian Critical Care 1997; 10(4): 132-3.
Summary: The purpose of this article is to discuss some of the Internet sites of interest to critical care nurses including WWW sites, newsgroups and e-mail and discussion groups. E-mail has a benefit over paper mail in that normal computer files can be attached to messages and sent quickly to other users in different cities or different countries. An e-mail document can also be sent to many people on a mailing list with ease. Discussion groups allow a user to send your e-mail to a central computer, which then sends it out to all those on its list of participants. Newsgroups are a more open form of discussion. Here your e-mail joins a collection of e-mail grouped in predefined categories. WWW sites are a method of displaying a screenfull of information on your computer. Once you enter a site's address, your computer accesses the files in that site.

Several WWW sites, newsgroups and discussion groups of interest in critical care nursing are listed.

Valish AU, Boyd NJ. The role of computer assisted instruction in continuing education of registered nurses: An experimental study. Journal of Continuing Education in Nursing 1975; 6(1): 13-32.
Summary: In this paper the authors describe the results of an experimental study to determine if CAI, as a continuing education tool, will verify and augment prior clinical knowledge in nursing. 124 nurses from the George Washington University Medical Center were randomly assigned to experimental (CAI instruction) and control groups. The topics chosen for the study were: 1) Septic shock, 2) Care of and Feeding by Veins and 3) Leadership and Management. The study was a posttest only control group design and nurses were evaluated using a multiple-choice examination and an attitudinal survey. There was no significant difference in performance between RNs who used the CAI program and those who did not. There was also no significant difference in performance of registered nurses according to educational preparation, age, years of clinical experience and department of employment. However, 96.3% indicated that the computer experience was valuable and 59% indicated that the course materials were not difficult. The authors conclude that there was perhaps a lack of breadth and depth of content in the courses used as a treatment variable, and that the knowledge in nursing 20 years ago was no different form the knowledge in nursing today (no differences based on age, years of experience, education preparation and department of employment).

Veldenz HC, Dennis JW. The Internet and education in surgery. The American Surgeon 1998; 64(9): 877-880.
Abstract: The purpose of this review is to explain the developing role of the Internet and the World Wide Web (WWW) in promoting education in surgery. Internet sites relevant to surgery are appearing rapidly. Remote literature searches can query for surgical trials and results. Societies are using the WWW for transmission and review of publication materials. News groups interactively discuss current developments and trends. Surgeons are using personal and institutional sites to advertise services. Conventional slide shows migrate to the WWW for convenient downloading for surgeons and patients. Multimedia capabilities of the WWW expand the depth of information transmission, enabling education emanating from remote sites with narration and video depiction of procedures. These sophisticated tools can be demonstrated today with real online applications. One site facilitates surgical education using the WWW for program information, symposium coordination, links to regional subspecialty societies, residency cataloging, patient question and answer forums and multimedia procedure descriptions. The principles of WWW communication used in this Website can be adapted to meet any educational need.

The specialty of surgery is well suited to incorporation of online multimedia education over the Internet to follow new developments in our field.

Ward R. Implications of computer networking and the Internet for nurse education. Nurse Education Today 1997; 17(3): 178-83.
Abstract: This paper sets out the history of computer networking and its use in nursing and health care education and places this in its wider historical and social context. The increasing availability and use of computer networks and the Internet are producing a changing climate in education as well as in health care. A move away from traditional face-to-face teaching with a campus institution to widely distributed interactive multimedia learning, will affect the roles of students and teachers. The use of electronic mail, mailing lists and the World Wide Web are specifically considered, along with changes to library and information management skills, research methods, journal publication and the like. Issues about the quality, as well as quantity, of information available, are considered. As more and more organizations and institutions begin to use electronic communication methods, it becomes an increasingly important part of the curriculum at all levels and may lead to fundamental changes in geographical and professional boundaries. A glossary of terms is provided for those not familiar with the technology, along with the contact details for mailing lists and World Wide Web pages mentioned.

Ward R. NHSnet: a cost-effective medium for continuing professional education. The British Journal of Healthcare Computing & Information Management 1997; 14(8): 30,32.
Abstract: This paper argues for the potential of NHSnet to be further realised by its use as an important educational medium for all NHS staff. This is placed against the clinical and managerial drives for the development of NHSnet. The role and philosophy of networked education, relating to student-centered approaches and improved accessibility are discussed, along with some of the technical issues.

Wedge KS. HyperDesigning: An instructional design model applied to the development of a HyperCard computer assisted instruction on intramuscular injection sites. Computers in Nursing 1994; 12(1): 17-22.
Abstract: As more instructional software is designed by faculty, it becomes increasingly important, as well as time efficient, that faculty approach development of software from an instructional design perspective. Today, faculty can select among emerging technologies and the future will undoubtedly present even more options. Educators who want to design their own computer assisted instruction (CAI) programs are frequently left to their own devices for instructional design. Instructional design models can provide helpful guidelines for selection and development of relevant programs. This article outlines the development of a faculty-designed software program using the Seels and Glasgow model of

instructional design. The Seels and Glasgow model employs the essential components of analysis, design, development, implementation, evaluation and diffusion with iterative intermediary steps.

Whiteside MF, McCulloch J, Whiteside JA. Helping hospital educators and clinical nurse specialists learn to use and develop computer-assisted instruction. The Journal of Continuing Education in Nursing 1990; 21(3): 113-7.
Abstract: The impact of computers on healthcare delivery and management is both significant and increasing. Coupled with its potential educational benefits, computer-assisted instruction (CAI) has much to offer healthcare professionals. However, the individuals directly responsible for training nurses and other personnel typically have little knowledge about how computers can be used for training purposes. A series of workshops was designed for hospital educators and clinical nurse specialists to help them become computer literate and to provide them with the skills to evaluate, develop and appropriately implement instructional software was emphasized during a series of formal seminars, guided individual instruction and guided independent practice laboratory sessions. This approach resulted in a significant increase in participants' knowledge about computers while maintaining their positive attitudes toward the instructional uses of computers. A well-designed staff development program can provide these crucial individuals with the skills and knowledge required to use microcomputers and CAI as effective teaching and learning tools.

Wieczorek RR, Price MR, Cannon C. A pharmacology review for private duty nurses using computers and self learning concepts. Journal of Nursing Staff Development 1998; 14(2): 95-7.
Summary: The purpose of this paper was to discuss the application of a computerized self-learning program offered to nurses who were required to take a National League of Nurses (NLN) pharmacology examination. The training program involved was to provide a basic proficiency in medication administration. 124 nurses chose the automated self-learning program. The nurses were then asked to complete a printed abbreviations quiz which was included in the information print packets, to assess their need for review. Nurses who needed review could then use a drill-and-practice program until they mastered their skills. They then completed a printed calculation quiz to assess their knowledge and skill in various areas of nursing practice. At the end of the program nurses completed a computer-administered examination and were given immediate feedback on their progress. Two weeks before the exam nurses were offered a 2-hour critical thinking session which was instructor-led. One hundred and ten nurses passed the NLN exam. Of the ten who failed, only one took the pretest and only 2 purchased the pharmacology review packet.

Willy C, Sterk J, Schwarz W, Gerngross H. Computer-assisted training program for simulation of triage, resuscitation and evacuation of casualties. Military Medicine 1998; 163 (4): 234-238.
Abstract: The purpose of this paper is to introduce a multimedia computer software package that has been developed for the Federal Armed Forces of Germany to train military physicians in trauma management. The program presents different groups of casualties with characteristic wounds and multiple injuries on a CD-ROM and provides many clinical options at each decision point. Automatically evaluating the decisions for accuracy, the objective of the program is to train for triage, resuscitation and evacuation of wounded in combat under pressure of time. The computer-assisted instruction program is inexpensive and allows easily accessible self-instruction as a supplement to formal classroom training. Using this teaching software, it may be possible to teach a standardized emergency case-management algorithm for battlefield trauma. There was a high level of acceptance for this type of instruction. This is encouraging for medical educators involved in producing multimedia packages for teaching emergency medicine.

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Summary: The purpose of this paper is to discuss the application of CD-ROM to the pharmacy profession. A single CD-ROM can hold over 600mb of information and most, if not all, offer some multimedia elements including video segments, sound, animations, illustrations and photos. Interactive continuing education is a perfect application for CD-ROM technology in pharmacy. Current journals can be viewed in a real time, in depth version, complete with video-clips, animated illustrations, or several minutes of a guest speaker. CD-ROM can also be incorporated into patient education. Programs in CD format routinely have extensive tutorials, some in video format, numerous examples of the software in use and information on additional sources of information. CD-ROM's are relatively cheap (due to their use in the entertainment industry) and most personal computers are now sold including a CD-ROM drive.

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Summary: The challenge of the modern educator is to find a means for handling the information explosion. The teaching-learning approach has to give way to an easier approach to encourage the development of problem-solving skills, which will enhance the student's use of knowledge. The problems presented in clinical practice normally require action based on sound knowledge as well as a skillful decision-making process. Case management simulation is one way of developing and evaluating the student's problem-solving skills. The authors developed a simulation concerning the diagnosis and management of acute disease in children to evaluate the

clinical problem-solving skills of the students. Students, including pediatric nurse graduate students, pediatric nurse practitioners, family practice residents and pediatric residents, are just now being recruited to test the simulation program.

Yerks AM. The Internet and pediatric nursing: guide to the information superhighway. Pediatric Nursing 1996; 22(1): 11-15.
Abstract: Today's health care providers are learning the technologies available on the Internet and World Wide Web and becoming more proficient at accessing information. Pediatric nurses are at a point where they, too, need to be able to use the information technologies that are available to them. The Internet contains resources such as directories, online medical and nursing texts, graphics and databases that are invaluable to nurses and all health professionals.

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